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THE TOOL ENGINEER

REG. U.S. TRADE MARK

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[illegible]ind every manufactured product is the tool engineer

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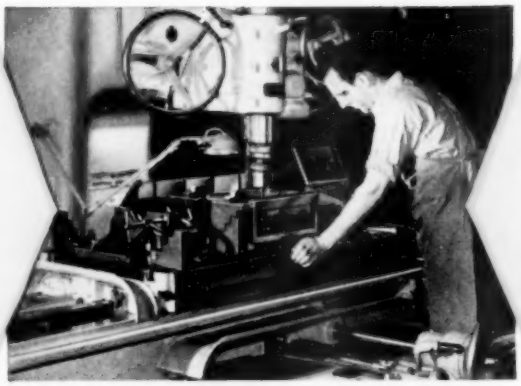

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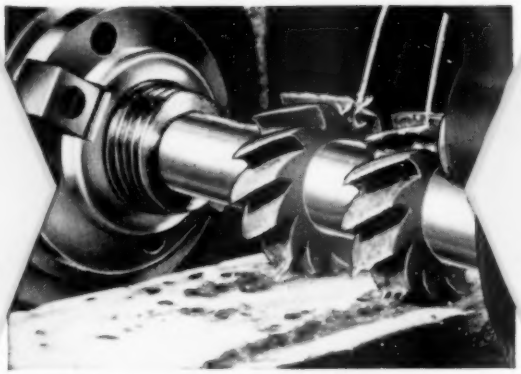

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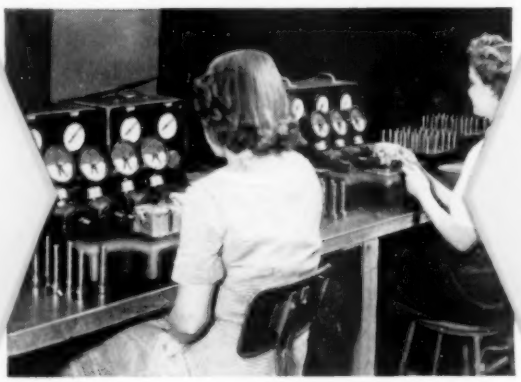

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March, 1950

Vol. XXIV No. 3

Editorial

There's Plenty in a Name!

THE COMPARATIVELY SHORT history of industry in the United States has had many instances, to date, where a completely new branch of engineering has broken from established engineering procedures and set up a new concept of an existing technology.

This break, when it comes, is usually in response to a tremendous demand for a new approach to technical problems, as was the case when the first tool engineers met and organized as a technical group in 1932. In the case of the tool engineers, the demand for a new science was sharply accentuated during the recent war, when it was found that the modern industrial organization needed a "production coordinator" in order to function properly.

That the new science of tool engineering is recognized is attested by the 18,000 membership of its strongest spokesman—the American Society of Tool Engineers. Recognition is also attested by the growing utilization of the tool engineer's abilities in coordinating manufacturing operations.

But one feels that the tool engineer, like so many masters of new technologies before him, has reached the points of development and acceptance where he should be known *as a tool engineer.*

Manufacturing, production, process engineering are a few of the terms used synonomously with tool engineering. The simple fact is that this confusion in terminology causes equal or greater confusion with respect to the scope of the various engineering fields. The manufacturing or production engineer is a tool engineer, and should be recognized as a tool engineer by profession and by title.

Much the same holds true for present college curricula. There are variations among colleges in the same area, as well as geographical variations in courses included in the curriculum and the degree granted. This confusion can be overcome only by universally recognizing tool engineering as a degree course, and establishing minimum standards among colleges in that course.

Industry can perform an important function in developing maximum results from tool engineering by instituting responsible tool engineering divisions—and calling them tool engineering divisions. By initiating proper personnel standards and setting up progressive organizational procedures, industry in the future will gain even more from the science of tool engineering than it has in the past.

R. B. Douglas

President 1949-1950

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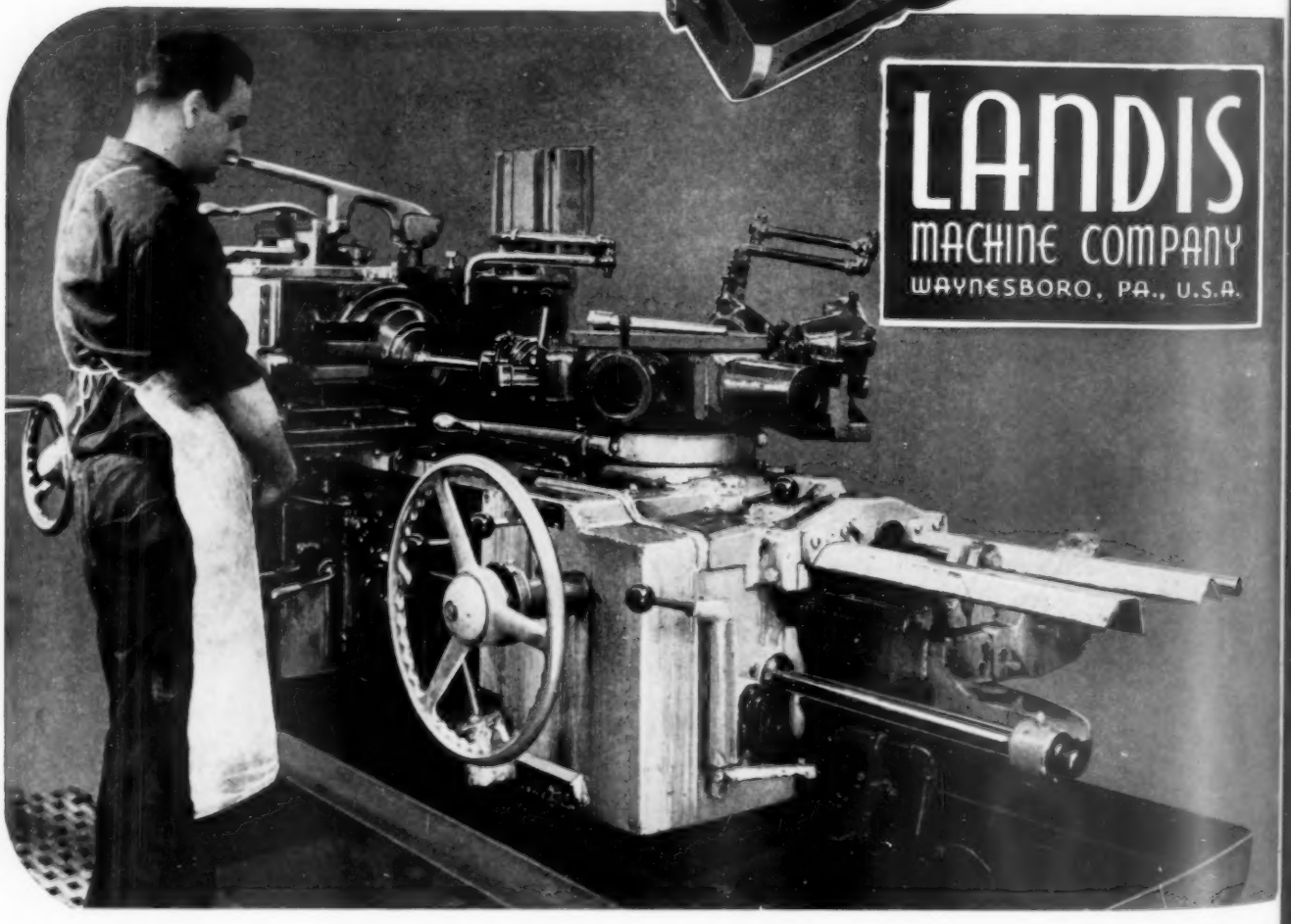
● Landmatic Heads can be equipped with an internal tripping attachment adjustable for various thread lengths. The heads open automatically when the front end of the part being threaded makes contact with a stop bar in the bore of the head.



This High Speed Chucking Machine has operation features for accurate turning, boring and threading of large diameter parts at production speeds. Prevailing labor rates make this machine an essential for lower manufacturing costs.

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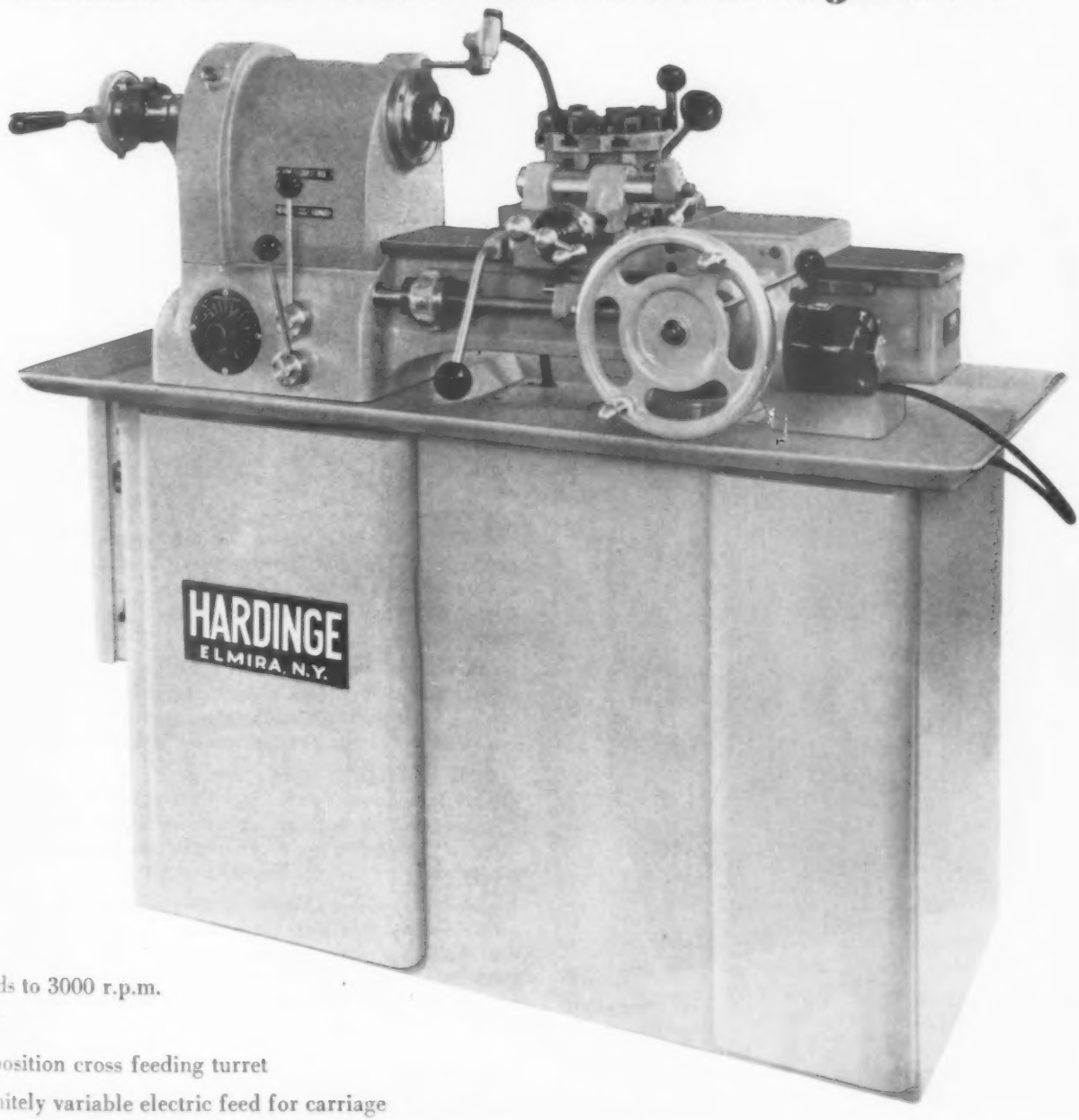

Spindle speeds to 3000 r.p.m.

Swing 13"

Eight position cross feeding turret

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High speed production threading head

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See this machine in action—Space 835
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April 10-14

Gear errors and Gear noise

should be discovered long before the gears reach final assembly . . .

See this and other Red Ring equipment in BOOTHS 601 AND 602 at the ASTE "COST CUTTING EXPOSITION" in Philadelphia, April 10-14

There is a profit in scrap for the scrap dealer, but most certainly not for the gear manufacturer who suddenly discovers that an entire lot of gears have to be scrapped because they fail to meet tolerance requirements or because they are too noisy.

If economy is important in your plant, the time to find out about machining errors is right at the machine which causes the trouble—not after all the subsequent operations including heat treatment have been completed and the gears assembled in some power unit.

The best insurance against high cost of scrap gears is the use of gear checking machines right down there in the plant where the gears are being produced and where they can be checked periodically by the machine operators.

The Red Ring Gear Checker quickly reveals any dimensional errors and the Red Ring Gear Sound Tester immediately puts an accusing finger on noisy gears. Both machines have laboratory accuracy, they can be used anywhere in the plant or inspection department and they prevent a great deal of waste.

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SEE US AT THE ASTE SHOW—BOOTH 932

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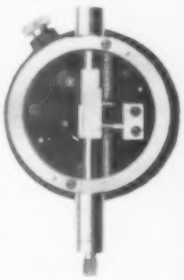

Proved by experience to prolong instrument life greatly, Standard's Shockproof Mechanism protects internal parts right from the spindle on. Furnished regularly in most models, not treated as an optional extra. Standard Indicators give longer, trouble-free life, need fewer repairs, are dependable. These facts add up to "Greater Economy."

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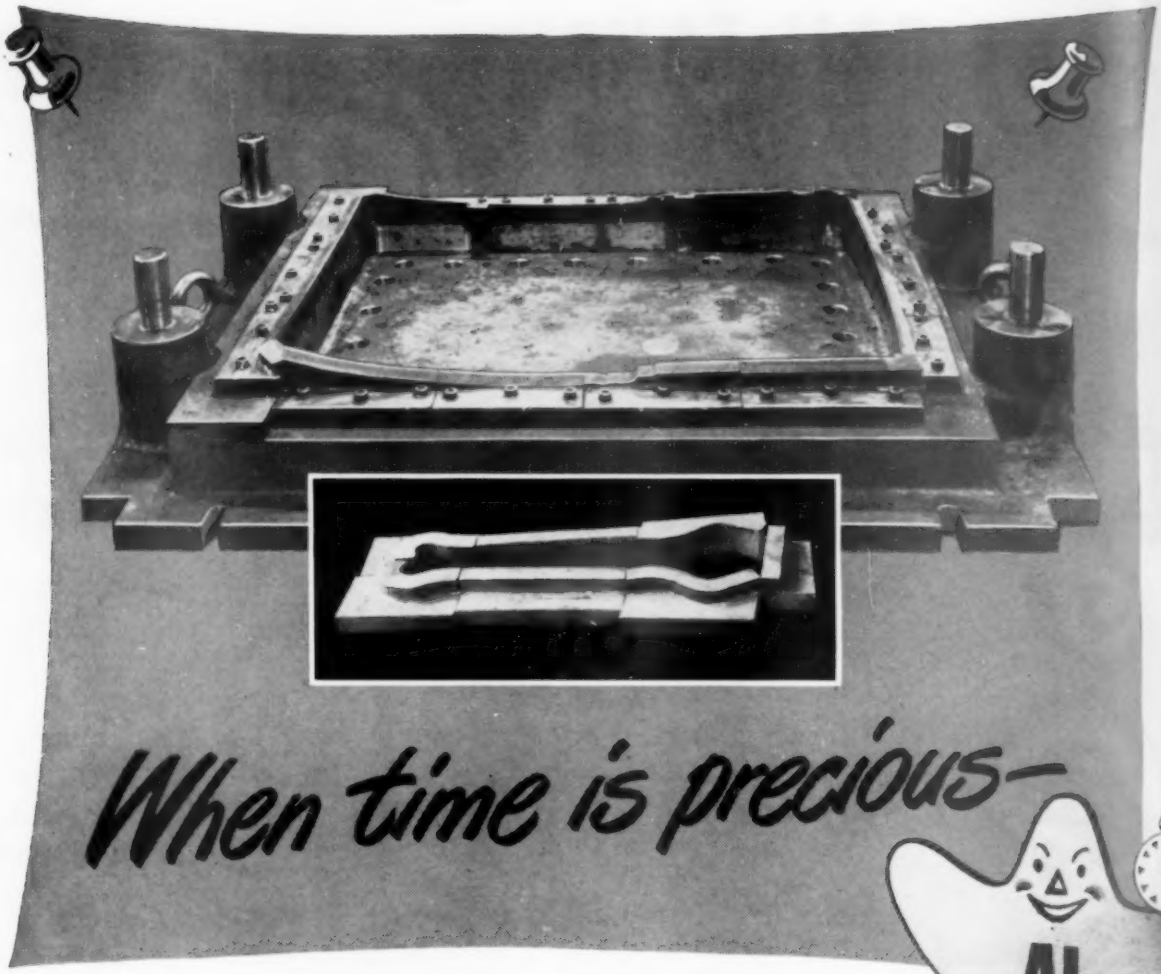

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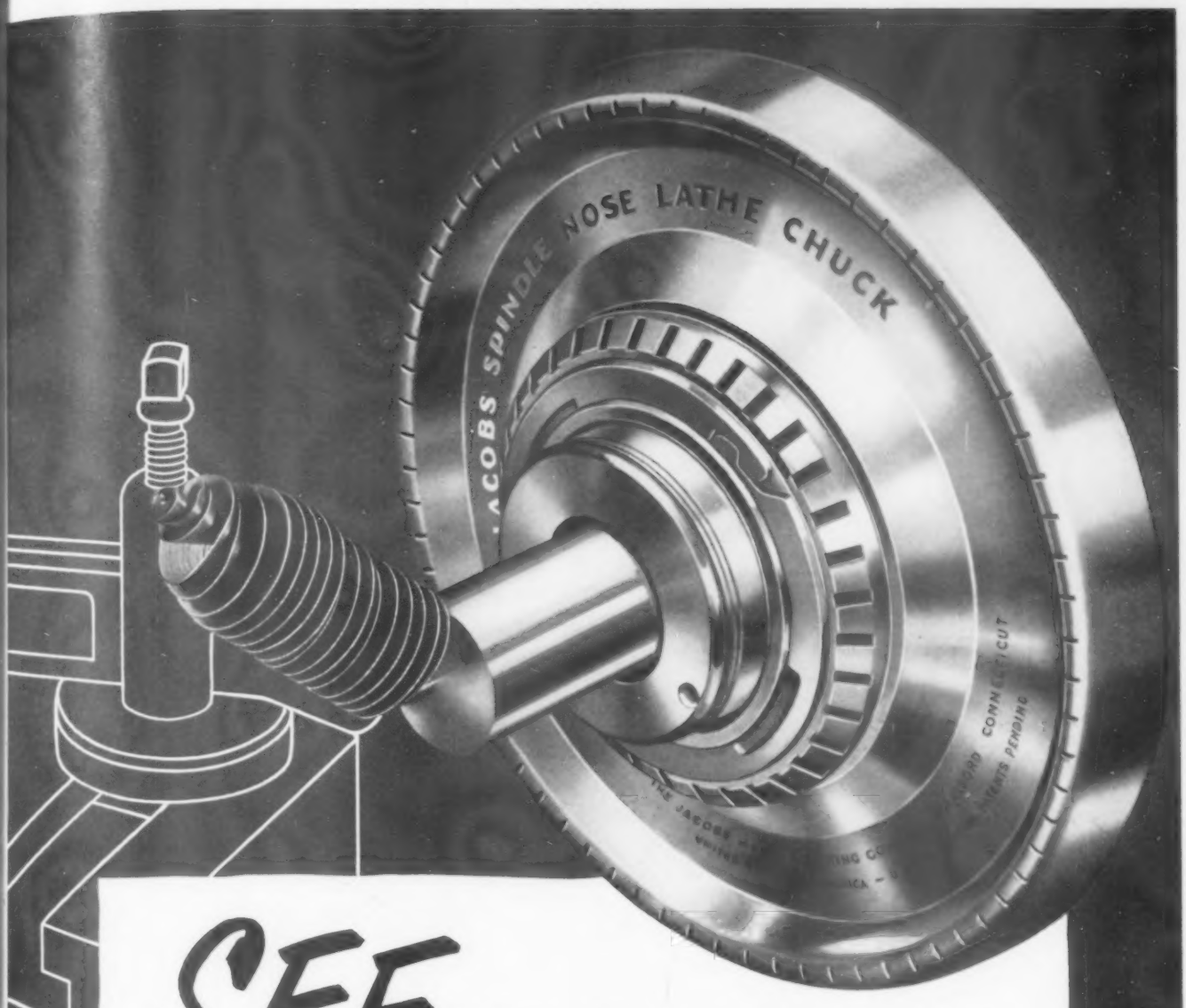

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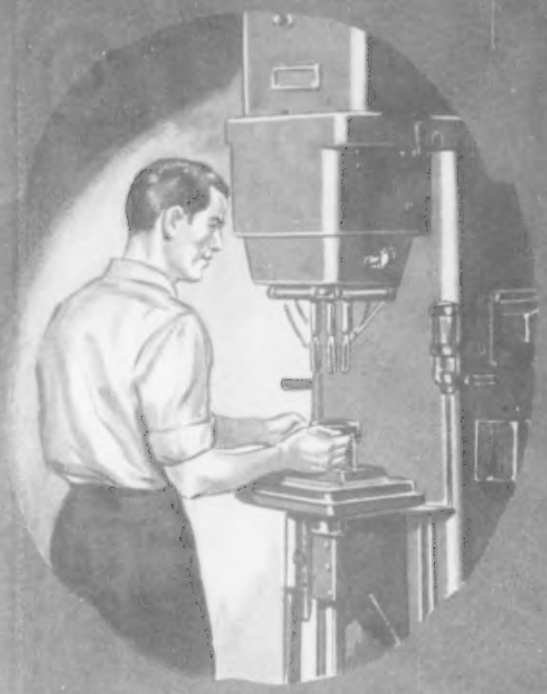

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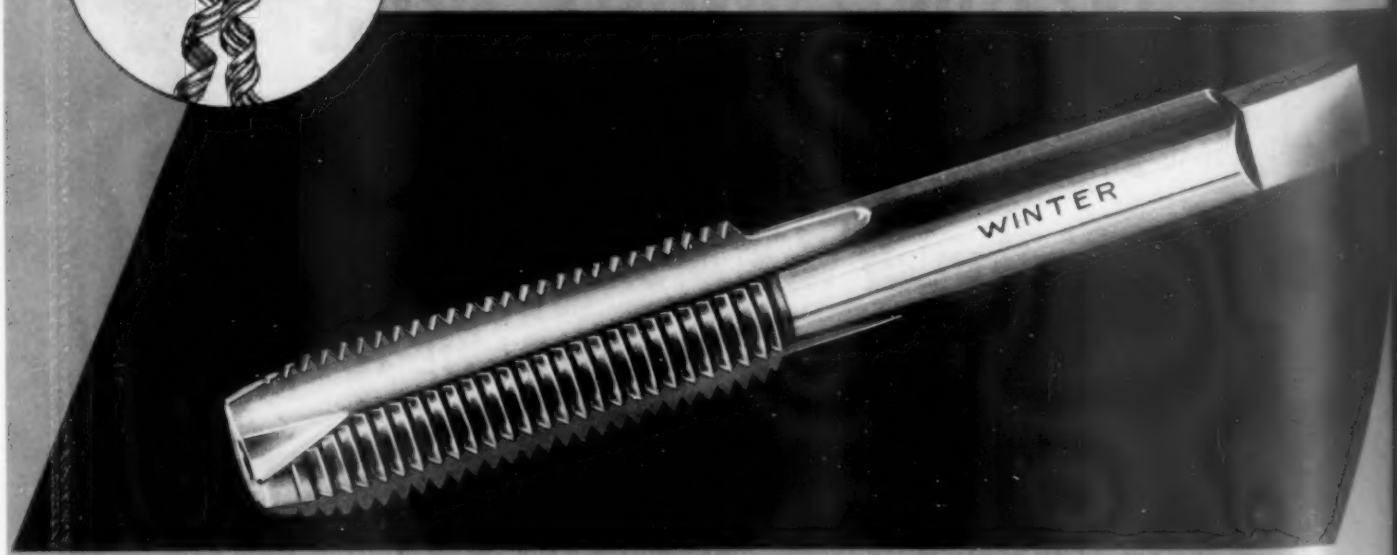

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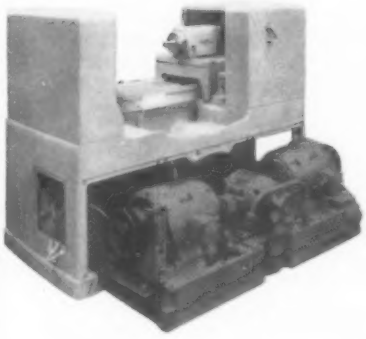

The pump, tank, and motor unit, as shown above, is separate from the machine base, and can be easily drawn out for inspection and servicing. With the entire assembly out in the open, all parts are easy to get at — easy to keep clean.

The separate power unit offers still another important advantage, too. It isolates motor vibration from the machine, for maximum precision and better finish.

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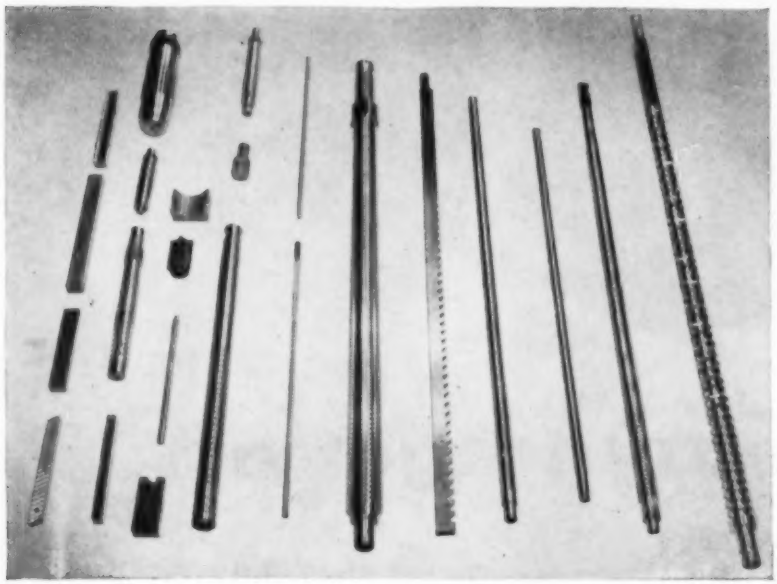

Keyway, spline, involute spline, surface, rotor-kut, serration, combination or burnishing—every type of broach can be engineered and built by American.

take broaches for example

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With No Glare Satin Chrome Finish
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With No Glare Satin Chrome Finish
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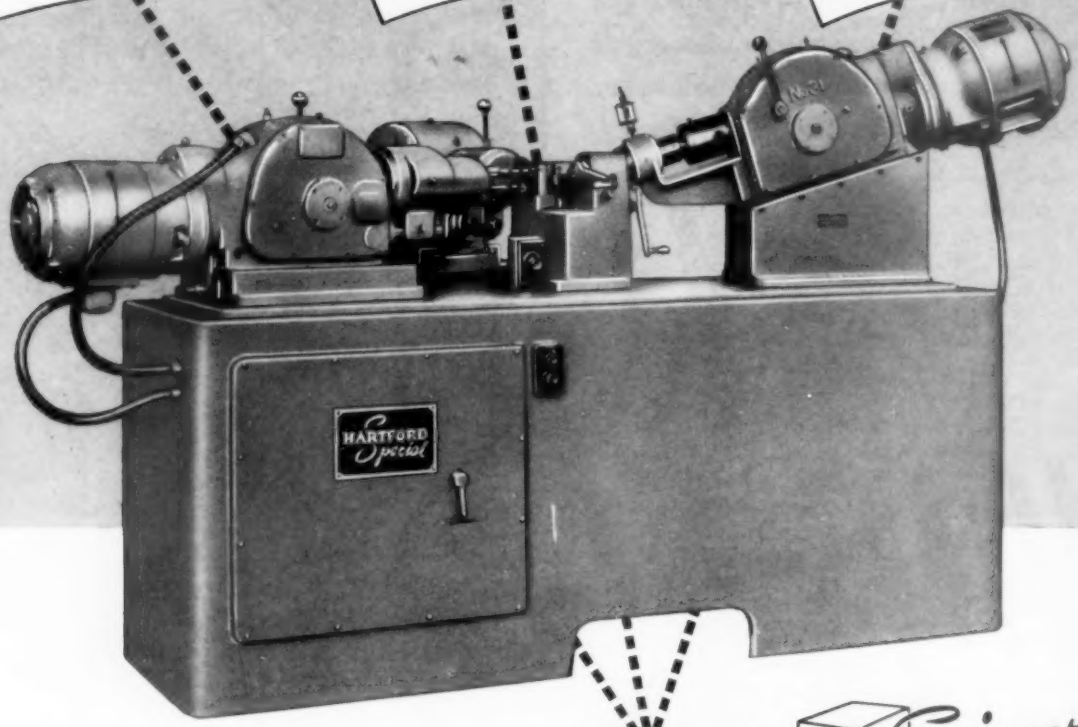
3 way approach to production

Two 21/64" holes drilled by this unit equipped with two-spindle drill head

This unit with two-spindle drill head drills two .261 holes

This angular unit hollow mills piece 1½" in diameter and faces end to length



The problem of drilling, milling and facing a very irregularly shaped piece in this job was solved by Hartford Special Engineers by means of a special two clamp fixture and a way type machine with three automatic units. The success of the machine is proven by the production rate, 175 pieces per hour. The solution of complicated problems in Automatic Drilling and Tapping machines as well as general single purpose special machines has made Hartford Special the "standard for specials."

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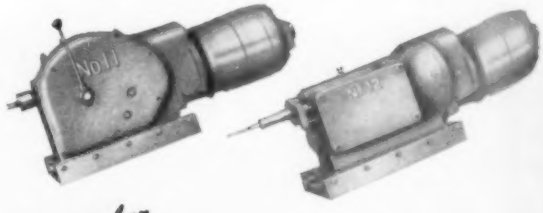

Remember

For special applications, Drilling and Tapping Units with or without attachable heads are available individually.

These concave harrow discs are ground and polished in one lightning-fast, dollar-saving operation with RESINALL METALITE Cloth Belts and backstand idlers. Typical of the versatility of this profitable combination is the way these discs are given a spun finish by the action of the abrasive belt, which cuts and at the same time revolves the disc on its ball bearing fixture. Removing the scale and polishing takes only 18 to 35 seconds of actual sanding time!

RESINALL METALITE Cloth Belts finish these and many other pieces faster and with less cost because they're resin-bonded to withstand hot, heavy-duty work. The special bond won't get soft and tacky and the belt definitely resists loading and glazing. RESINALL METALITE Cloth Belts cut sharp and fast all the way.

Behr-Manning abrasive belts are slashing finishing costs everywhere. Whatever the material or shape of your products, it will pay you to check with our field engineer in your area. A new bulletin, just off the press, tells the whole story. Write for it today.

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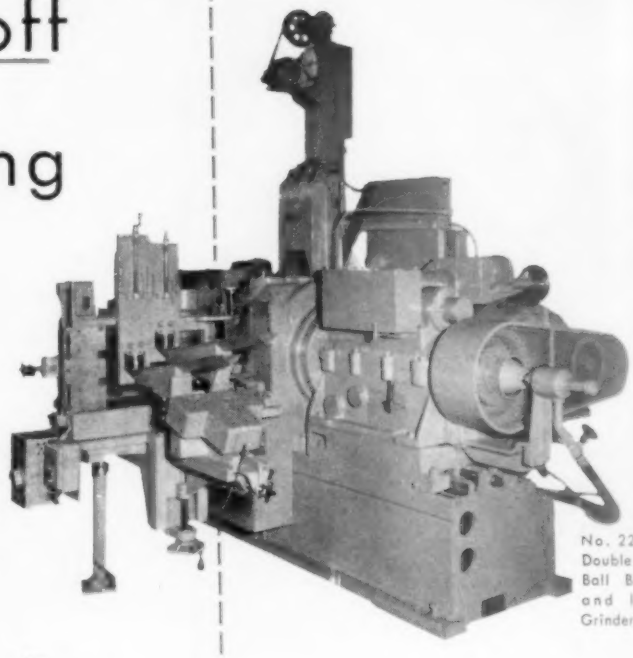
Use NORTON® *abrasives Sharpening Stones*

in grinders . . .

your pay-off for choosing BESLY is results like these!



No. 226-30" Besly Double-Spindle Wet Ball Bearing Outer and Inner Ring Grinder.

*** RESULTS**

. . . 30 automotive valves per minute

Finish grinding of stem ends with No. 218-20" Besly Grinder. Ends are ground square with stem .002" for length—within a tolerance of .0003" locating from taper seat. 15-20 micro-inch finish is imparted. One grinder handles all valve stem sizes with a single fixture.

*** RESULTS**

. . . 24,000 ball bearing races per hour

Piece-to-piece dimension tolerances held to .0002"—with No. 226-30" Besly Double-Spindle Wet Grinder. Approximately .007" stock from outer races .218" wide and 1½" in diameter is removed. Work produced is parallel within .0001". *Maximum* capacity of the machine 30,000 ball bearing races per hour!

*** RESULTS**

. . . Up to 3000 coil springs per hour

with this No. 926-42" Besly Double-Spindle Vertical Grinder. Ease and speed of loading sharply increased. Wheel dressing greatly simplified. Change from one spring size to another quickly made.

*All names furnished upon request.

Just as they have done in the case studies reported here, the chances are Besly Grinders can help you to lower-cost production and improved quality of output. *In scores of other companies they have achieved similar results.* So, call in the Besly engineer. Let him show you whether your grinding operations can be made more efficient. In addition, it is very likely that he can point out new applications in which a change-over to grinding can substantially reduce your processing costs. Such a survey costs you nothing—but the experience of the Besly engineer and engineering organization can be invaluable to you. Write us today.

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Advances in Inspection

By Dorian Shainin

CHIEF INSPECTOR
HAMILTON STANDARD DIVISION UNITED AIRCRAFT CORP.

QUALITY IS *not* perfection, in terms of exact reproducibility of dimensions, finer surface finishes, extra strength, etc., at which this control is aimed. Rather it is a minimum overall cost (considering cost of production, control, scrap, rework, service adjustments, good-will, which is the goal and which establishes the risk levels for the design of the quality control plans to be employed.

The inspection function is more and more bent upon assisting in building quality into the product, and then verifying, before the finished product is readied for shipment, that the quality control effort was successful.

This trend is beginning to have an effect on the inspection equipment employed. To control the product as it is being fabricated requires gaging equipment in the hands of the operator, and this a measurement or indicating type of gage rather than a limit or go and not-go gage. The operator is then ready to improve upon the more conventional manner of controlling the machine which is accomplished by determining the relation of a periodic individual piece to the drawing tolerance. A Shewhart[1] type control chart, one of the most useful tools of statistical quality control, recognizes that all processes have inherent variations, and permits plotting in the order of production the results of measurements on three or more parts taken periodically as samples. The results from each sample are transformed into two numbers: the average size and the difference between the smallest and largest measurement (range). The patterns of the average and range points remain within easily computed boundaries when production variation is stable, but they set up warnings when the process wanders or some new variable not continuously characteristic of the process enters the picture.

In the metalworking industry go and not-go gages are making a valiant but speculative stand against the indicator gage for process control purposes. Control charts of a sort, that show three bands—tight go, free go, and not-go—are supported on the argument of simplicity. Dodge's[2] sampling plan for continuous production with such fixed type gages guarantees in the long run a limiting percentage defective of the accepted output of a process. Measurements, on the other hand, give much more information than do limit gages, so that more powerful statistical methods can be employed and the result is either a reduced requirement for the amount of sampling or operation at reduced risk levels.

Leaving the production control areas and entering the environment of product acceptance inspection one finds this gage battle still predominated by the fixed-type gages. Many (go and not-go) type sampling plans are in use to separate lots into those that could be accepted without inspection beyond that of the sample, and those that must be screened to remove defective pieces. Variable sampling plans (indicating gage type) were considered too complex for inspectors to use until the recent development of the Lot Plan[3] which, in the last two years, has found extensive use within the inspection departments of some thirty concerns in the country. This plan, simple enough for the inspectors to administer right at their benches, retains the advantage of more powerful analysis characteristic of variable statistics. Thus the plan is able to indicate the presence of defectives in lots more effectively than even by 100 percent inspection (which is plagued with inspector fatigue oversights) as has been demonstrated by many of the concerns employing it.

For the next few years, however, fixed-type gaging will still predominate in the acceptance inspection field. The variable-type plans still must establish their right to tackle the checking problems of the country's many industries.

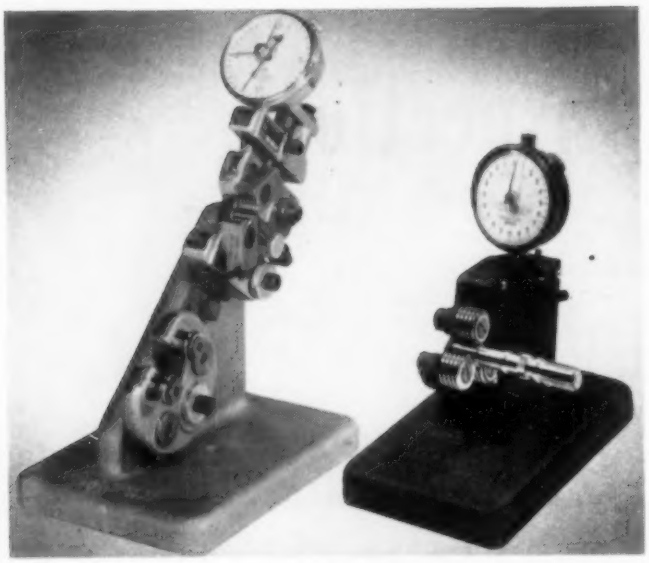
The fixed-type gages have had most of their clever design work accomplished several years ago, although it is surprising to realize the number of concerns that do not know or have not taken advantage of these developments. Easy entrance configuration on plugs, reversible plug ends, thread rings that have a sharply-defined relief extending well above the maximum product major diameter and those that stay round after adjustment for wear, the use of sintered carbides for plugs and rings and shock-resistant handles were perhaps outstanding examples of such work. Carbide precision gage blocks were first introduced as end or wear blocks to extend the life of a set of steel blocks. They proved to be so practical and economical that now complete sets of such blocks are being used and many replace their worn steel blocks with them. A great many other concerns are finding a vertical adjustable measuring bar with one-inch gaging steps to be much faster than using gage blocks for a great deal of surface plate and gage setting work. Receiving gages for splined shafts and even more involved and irregular shapes will always serve a definite need, but the desirability of being able to determine which of several dimensions is in error and by how much when the part does not enter the gage is encouraging the use of other than limit gage methods.

The only really recent developments in fixed type gaging appear to be in the category of screw threads. In November

[1] Dr. Walter A. Shewhart, Member Technical Staff, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

[2] Mr. Harold F. Dodge, Quality Results Engineer, Bell Telephone Laboratories, Inc., New York City, N. Y.

[3] Completely described in "Statistical Inspection Pictures Cut Material Procurement Costs", paper No. 48-A-88, ASME, 29 West 39th Street, N. Y. 18, N. Y.



The essential facts of a screw thread are known when the part is subjected to two independent checks; first, an overall or functional check; second, a minimum pitch diameter check, with an optical comparator standing by to check each run. At right is an external thread comparator, which features easy interchangeability of rolls and absence of back stop.

of 1948 the screw thread standards in sizes ¼ in. and larger of all inch-using English speaking countries were unified. While any new product made to the Unified Standard is interchangeable at assembly with the old, working to the new standards will mean that we shall have completely interchangeable threads with Canada and Great Britain. An "initial clearance" is allowable between the minimum tapped hole and the maximum screw, pitch diameter tolerances are based on a three-part formula which considers diameter, length of engagement and pitch, and these tolerances for internal threads are 30 percent greater than those for the external. The evidence of growing use of the Unified Standard in this country is beyond the experts' expectations. The more realistic tolerances and the minimum clearance feature ease much of the power wrenching and plating allowance problems—these could be called the practical reasons for adopting the new standards.

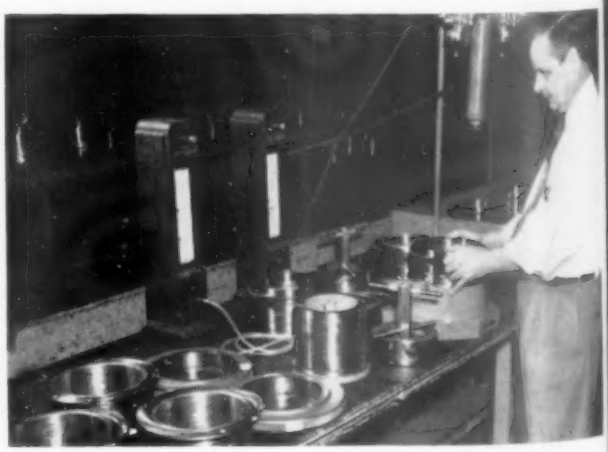
Another step forward in fixed thread gaging is a plug to check rings and snap gages for wear as it affects thread angle, taper, and insufficient clearance of major diameter. The "wear check" or "wear limit" plug is simply one with a pitch diameter that is larger than that of the standard setting plug by, say, the "total cumulative tolerance",[4] while it is truncated to the pitch diameter. When the check plug enters a ring or passes a snap gage set to the *full form* section of the AGD truncated plug, it indicates that the maximum allowable wear limit has been reached.

It is becoming quite apparent that the dial indicator-type of mechanical gage will always be a basic method of measuring. It holds first place in the field of measurement by variables because of its versatility, low cost, and because its general accuracy is sufficient for a large proportion of requirements. Today's trend is to adapt it more simply and more cleverly for specialized and semi-universal applications (noteworthy examples are a popular internal length comparator, and gear and spline comparators which locate from internal and external teeth of any desired form by using split, adjustable, self-centering teeth) and to protect the dial indicator from careless handling.

A mechanical dial indicator-comparator of conventional design can be built to maintain a reasonable relative accuracy up to about 700 magnifications. In shops all over the country, today, we find that quite often dial indicators are selected with a magnification that is too great for the job, that the accuracy feature has been so overemphasized that inspection and production superintendents refuse to procure them on the ground that "our work is not that fussy that we need dial indicators". Approximately 40 percent of the dial indicators sold are for those graduated in 0.0001 in., while undoubtedly many of those applications would be better off with a 0.0005 in. or 0.001 in. indicator. Those who hold on to fixed plugs and rings on grounds of the work not being fussy are overlooking the time and cost saving brought about by the elimination of progressive wear, of the greater error effect of lack of *extreme* cleanliness of parts, of manufacturing and wear gage allowances that prevent the taking of the full work piece tolerance range for longer cutting tool, grinding wheel and honing stone life, and of the need of setting up rejected pieces to determine their proper disposition.

Some internal threads, down to ⅜ in., and many external threads are having their pitch diameters checked with the aid of dial indicators. The Unified Standard situation emphasizes an advantage for the indicating thread comparator over the fixed type gages—the same gage can be used for the American, Unified, and Special thread pitch diameters without increasing the number of setting plugs required.

Pitch diameter tolerances, of course, are cumulative and include variations in lead and angle. One school of thought says—the only correct way to check a thread then is to project a shadow of its profile onto a glazed screen, and the entire profile should fall within the thread form envelope which are displaced one-half the pitch diameter tolerance apart. The relative position of the shadow to the limit lines on the screen is established with a setting plug. Another school says they want go and not-go rings; then they know their product will assemble. Then we have inspection departments that use thread rolls, (with or without indicators) all the way to groups who make thread checking a very laborious procedure involving separate determinations of lead, form, angle, pitch, minor and major diameters, taper, entering thread, and out of round. To these discussions, we might add our feelings—the essential facts of a screw thread are known when the part is subjected to two independent checks—first, an overall or functional check; second, a minimum pitch diameter check. The first assures assembly and the second dependability. A minimum amount of gaging to accomplish this check would be a go ring gage and a not-go roll-snap gage constructed with a single Vee and a single Cone, with an optical comparator standing by to spot-check each lot for the freak runs that could theoretically pass the go and not-go check. Better yet, the advantages of the ring gage can be kept while dispensing with its disadvantages of rapid wear, time to insert and remove work, and lack of



Multiple jets in both male and female air gages give average diameter readings which permit prediction of oil leakage between a pair of transfer bearings prior to their assembly.

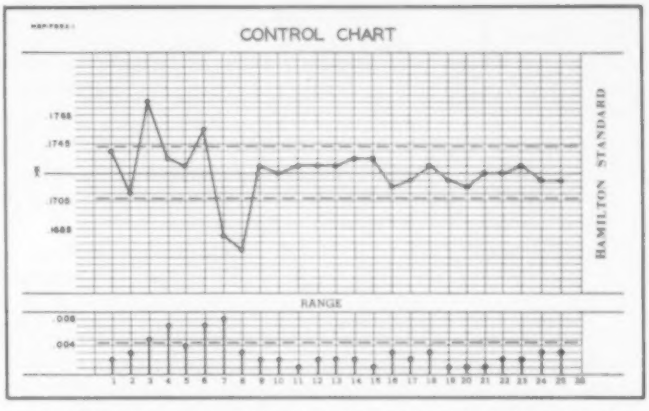
[4] "Screw-threads Standards for Federal Services" Handbook H-28, 1944, U. S. Dept. of Commerce, National Bureau of Standards, Table 9, Columns 13-17.

knowledge as to amount oversize of rejected pieces by employing a gage having two segments (a basic ring gage cut in two) with a length of engagement corresponding to the application of the thread, which operates a dial indicator.

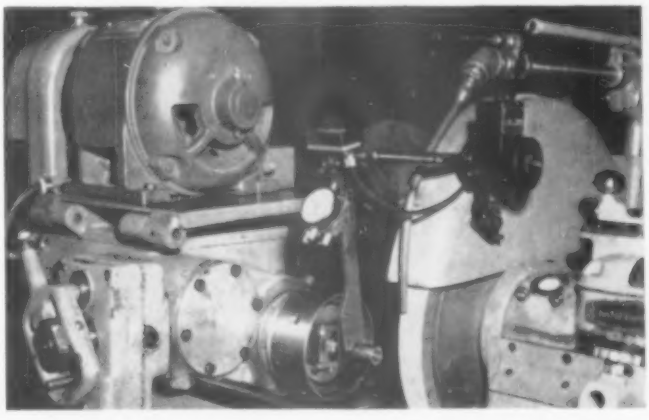
Here again, the proposal of a wear check plug, mentioned above, holds for this screw thread comparator in revealing any of the three types of "use" errors. The major diameter clearance is of particular importance in the comparator type device, because of the maximum major diameter and the minimum pitch diameter combination, which results in a "closing in" of the gaging elements. The check plug for the comparator consists of a go and not-go and made to the pitch diameter limits of the product, but each plug is divided into two sections that differ only in their outside diameters. On the go, or maximum PD end, half of the thread has an OD that is greater than the maximum product OD by the product PD tolerance, and the other half has an OD that is less than the minimum OD of the product by the product PD tolerance. On the not-go, or minimum PD end, half of the thread has an OD equal to the maximum OD of the product, and the other half has an OD that is less than the minimum OD of the product by *twice* the product PD tolerance. The comparator is thus set to the truncated portions of the plug, and the differential reading between the full and truncated plug sections is indicative of the wear conditions. The allowable wear factor (differential reading) could well be set at the "total cumulative tolerance" allowed for Class W accuracy gages.

Before leaving the realm of strictly mechanical gages, mention could be made of a vernier caliper we have seen that measures directly hole-to-hole center distance without needing to know the hole sizes. It is a type of double-acting caliper which, by a two-step application procedure and by having a special treatment of the scale, allows for the true sizes of the two holes involved and produces the true center distance as a direct reading.

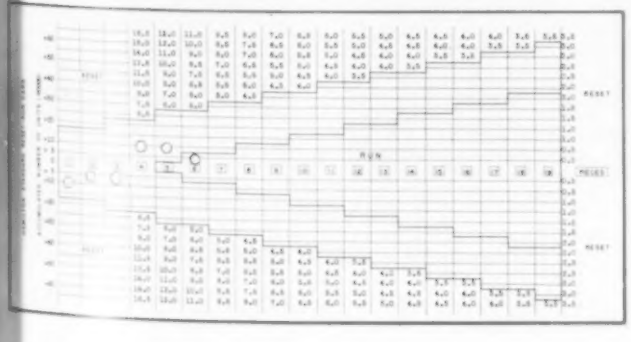
An increasing number of specialized gaging requirements in the past several years has brought forth applications of the principles of optics, electronics, and airflow in interesting combinations with mechanical elements. A mechanical-mirror type comparator, consisting of simply a magnifying lever arm with a mirror mounted at the end of its long arm, obtains further magnification without loss of accuracy by the use of an optical light-beam passing through lenses and which is reflected by the mirror onto a scale. This gage gets the magnification up to 1,000 to one, gives long service with a minimum of wear, and can operate with a very light spindle pressure. An improvement of this mechanical-optical tie up is the widely-used reed mechanism. This contains a lens and prism optical projection system which can get the magnification up to 20,000 to one and, of course, is available in

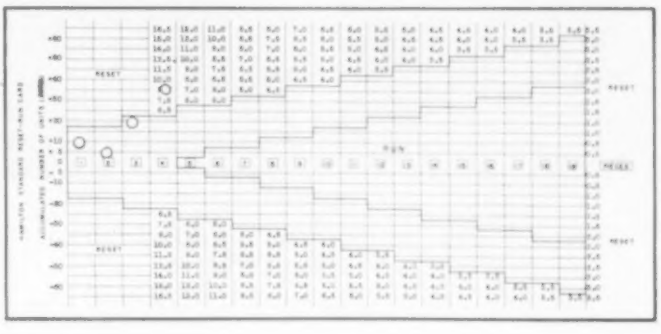


A battle is being waged between automatic sorting equipment (top) and statistical quality control (above chart).



(Right)—Automatic size control goes one step beyond statistical control by eliminating the effect of all the variable characteristics of the process, except those of the precision of the size control apparatus. Below, left, is shown a simple card with ticket punches, which indicate whether automatic sizer is giving satisfactory results. Here the successive holes enter the "run" region after six pieces are measured. Below, right, shows card with punched-out holes for only four pieces run into "reset" region. This automatic sizer, while reading ok on the controlling indicator, is producing work about 0.00009 in. too high. (The number 9 was punched out.)





smaller magnifications down to 500 to one. The reed mechanism is a simple, frictionless device that consists of a block fixed to the gage head case, and an adjacent floating block which is connected to the fixed block by horizontal steel reeds. Motion of the spindle causes a vertical reed on the floating block to move past another such reed on the stationary block. These two vertical reeds are attached at the top, so this spindle motion causes the reed combination to arc in a magnified movement. From this point on, the optical magnification takes over.

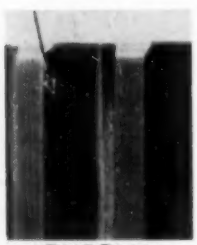
Two other and popular competitive principles in this band of magnification are the electric bridge type and pneumatic comparators. The former utilizes the spindle movement to unbalance a bridge circuit thus causing a current flow measured on an ammeter which is calibrated in a dimensional scale. The air gage records the reduction in pressure that accompanies an increased rate of flow, the escape of air from the gaging nozzle being related to its distance from the work surface. Some of the most extensive work in applications not nearly as well accomplished by other means is being done with air gages. Magnifications have recently reached as high as 60,000 to one. Contact points which meter the air out of the gaging nozzle give a reading that is entirely unaffected by coarse surface finishes. Multiple or annular jet spindles indicate the average diameter of a hole, and together with a similar configuration in an air ring permit the determination of leakage past oil transfer bearings from the average readings before the rotating and stationary components are assembled. Difficult squareness and hole straightness inspection problems easily succumb to air. Even the average diameter of ball bearings, and the relative angular location of a cross hole or slot in a bore independent of the hole or slot size are measured by air flow.

Usually applied to still more specialized requirements, with magnifications running from 2,500 to one up to 30,000 to one are the gages that use electronic means of amplification. A current which is induced in a movable coil attached to the gage spindle, is fed to a voltage-dividing network whose output is greatly magnified by a stabilized amplifier. This radio-frequency current is rectified to pulsating direct current which records on an ammeter the amount of current flowing though the detector circuit. Industry's requirements are pretty well covered with less costly comparators. So far

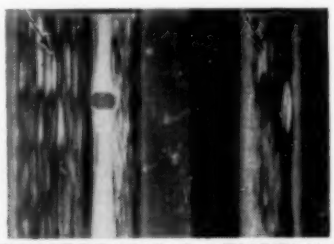
Inspecting the insides of a pocket watch, using a front surface reflection attachment on an optical comparator.

electronics has not done very much to supplant the other types of comparators.

Each year brings a number of new applications of these specialized gages. Perhaps too often a high magnification gage is selected, only to find, when it is on the job, that the working conditions are such as to cause from one moment to the next dimensional variations of such magnitude to make the gage appear to be unreliable. However, there will always be a place for high optical, electrical and pneumatic magnification in gage control work, in production control for checking periodic samples for statistical control purpses, and in Lot Plot acceptance inspection. One trend with such equipment for high quantity production was to have it operate limit lights, sound signals, and the like but there seems to be a growing feeling that for effective go and not-go or sorting type of inspection with such sensitive equipment, the operator with his human failings must be minimized by the automatic adaptations where the disposal of the work into categories is untouched by human hand or unaffected by human mind. Cost, of course, is the big deterrent to this logical step, and so there will always be applications that are not automatic on the strictly false assumption that careful selection of inspectors, proper supervision, etc., will guarantee

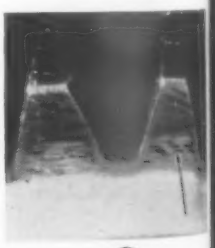


ABNORMAL TEMPERING INVOLUTES



REHARDENING & ABNORMAL TEMPERING IN INVOLUTES AND ROOTS

ABNORMAL TEMPERING IN INVOLUTES



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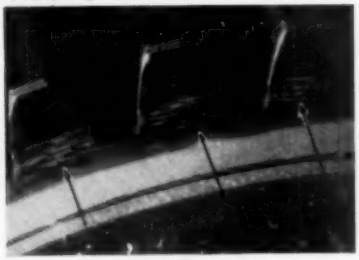

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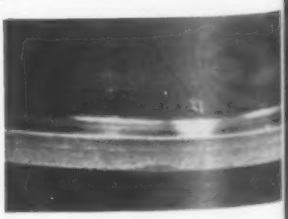
A-B-C REHARDENING & ABNORMAL TEMPERING IN END FACES

O.D. OF SHAFT



O.D. OF SHAFT

REHARDENING & ABNORMAL TEMPERING

Flaws emphasized by surfaces temper inspection are shown above. This non-destructive method utilizes immersion in an acid solution to produce selective surface discoloration, which indicates localized overheating of the metal.

e desired results. Even the automatic equipment needs equent checking of settings, since such equipment seems have an insidious habit of every once in a while being off a setting not enough to be obvious but enough to require ge quantities of "sorted" material to be resorted after conderable trouble is encountered with the material. Moreover, ere is the problem of indecision of the apparatus involved ith the exact boundary between one classification and the ext. Today these problems have touched off a skirmish beeen automatic gaging and the use of statistical methods. he use of automatic gaging means the production process mply cannot hold to the requirements, perhaps without seective assembly, or that there is fear that any other inspecon method either will not pick out "all" the possible defective product, or it will not be as economical as automatic aging. When the particular statistical method appropriate the process is properly applied, many—but not all—processes were found to be able either to hold to a much tighter tolerance than believed possible (and could continue to do so with a control chart) or could be altered as determined by careful rational selection of subgroups (to borrow some statistical terminology) to narrow the range of variation, sometimes quite substantially.

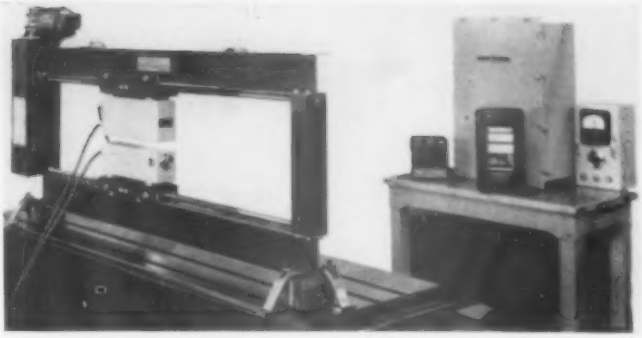
Automatic sizing, as has now been successfully applied to main grinders, goes one step beyond statistical quality control since it replaces the effect of all the inherent variables of the process with just those characteristic of the precision of the sizing apparatus—provided that reasonable conditions of work, speed, feed, and correct wheel are maintained. The speed is automatically cut from fast to slow grind by the electric gage as the indicator nears zero. When the workpiece is ground to size, the machine is automatically stopped.

The statisticians, however, do not give up easily. They have already worked out a Reset-Run card that periodically reports to the operator whether the size control device is set correctly and is continuing to operate as intended. Readings from a reasonably high magnification comparator from successive pieces as they are *out of the machine* are punched out on the card as so many lines above or below zero for the first piece; so many lines above or below the *previous* hole for the second piece; and so forth. When the boundary line into the region marked **RUN**, or that marked **RESET** is reached by the successive holes, the last of which gives the net or algebraic sum of all readings, the measuring stops. In the former case the automatic machine is running fine, while in the latter case the ticket punch will have knocked out a number. That number indicates the number of units away from the desired value the size control device is averaging as a finished dimension that will be presented to inspection.

A most useful development in optical comparators, often called shadow-graphs, is the front surface reflection feature available as an accessory attachment to older units as well as being built in to many modern ones. With it, at any of the standard magnifications up to 100X, one can focus the reflection at different depths into the work and so solve many a difficult layout type inspection problem on small parts.

Because of the increasingly strict and complex design requirements of many new products, look in the future to more of the following:

1. Better surface finish control. Tracer contact methods are reliable but possess serious limitations. Reports are not encouraging from light reflection devices that actuate meters. More and more people are going to the "penny" or fingernail opinion comparison test against graduated standards. Air gaging seems to have interesting possibilities but trouble is being encountered in the development work with distinguishing among the finer finishes.
2. When only one side is available, testing thickness of metals and certain other materials, for lack of bond, and for flaws (in the out of welded areas) in steel and nonferrous metals. Some excellent results are being found in the first two tests by generating supersonic energy, projecting it into the material and reading along a calibrated scale its natural frequency on a cathode-ray oscilloscope. Detection of flaws that escape X-rays and magnetic particle inspection is being accomplished with supersonic waves directed into the material and measuring the time elapsing between the initial pulse and the return of its echo. Lack of bond is also being found with an electrical probe that measures the resistance path from points on one sheet of steel to the other to which it is bonded.
3. X-rays are being found to be useful for other than their conventional purposes. Complete freedom from foreign particles in internal, hard to get at, passages of components of complex hydraulic assemblies, and wall thickness of critical inaccessible internal structural members after sand blasting are problems that defied solution by any other method.
4. Surface temper inspection. A non-destructive means of testing steel parts, for indications of abnormal tempering or rehardening occurring on surfaces as a result of grinding, polishing or buffing operations, which is accomplished by immersing the work in nitric acid and hydrochloric acid solutions to produce selective surface discoloration. Areas darker in color than the surrounding treated surface indicate that localized overheating has produced abnormal tempering of the surface with consequent lower hardness. Areas lighter indicate local overheating exceeded the transformation range of the steel resulting in rehardening.
5. Continuous measurement without contact of thickness variation in strip or sheet material as it comes off the rolling mill. Beta Rays and X-Rays are being employed for steel, copper, brass, aluminum, rubber, plastics and glass. The X-ray gage handles the higher thickness ranges and operates on the principle of measuring the difference in intensity between a reference beam and the measuring beam which passes through the material, the density of the material determining the amount of X-ray absorption. The Beta Ray continuous gage is even a more promising device since it is not affected by changes in the chemical composition of the material. It weighs a fixed area of the moving strip using a small beam of radiation and can handle thinner sheets than the X-ray unit as well as accommodate other materials such as paper, asbestos, textiles, mica tape, photographic film bases, sheet wax, etc. A delay in response of the reading as the thickness changes is a characteristic of this gage which may be somewhat longer than some users would desire.



Traverse mounted Beta ray continuous gage for scanning sheet thickness off the rolling mill.

Materials Handling in Manufacturing

By J. I. Webb

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THERE ARE IN INDUSTRY many instances where tooling for particular operations has overshadowed at the expense of the overall efficiency some of the necessary steps, both prior to and subsequent to production operations. One of these is materials handling. The term "materials handling" is a very general term, and often is not thought of as such. It is one of the items so often overlooked by the manufacturing engineer as he plans his tools. The first of the materials handling problems is that of getting materials from the source of supply, whether this source be another company, or another department or plant of the same company. Another materials handling situation is the movement of the product as an element of a productive operation. Usually there are as many of these handling operations as there are productive operations. There is a third kind of materials handling—that of getting the material from work station to work station in the most efficient manner, taking into consideration the job conditions which, of course, vary widely with the different products. In the manufacture of many products, there is a materials handling problem in connection with storage, whether this be raw material, semi-finished parts, or finished stock. Usually, the last operation performed on factory products is that of shipping. This is a matter of materials handling and justifies careful study to keep its costs to a minimum.

Since the basic character of materials handling affects all manufacturing activities, it obviously cuts across present factory organization lines. Therefore, it is essential that the personnel in all phases of manufacture coordinate their efforts with those of the material handling engineer if worthwhile results are to be accomplished along this line.

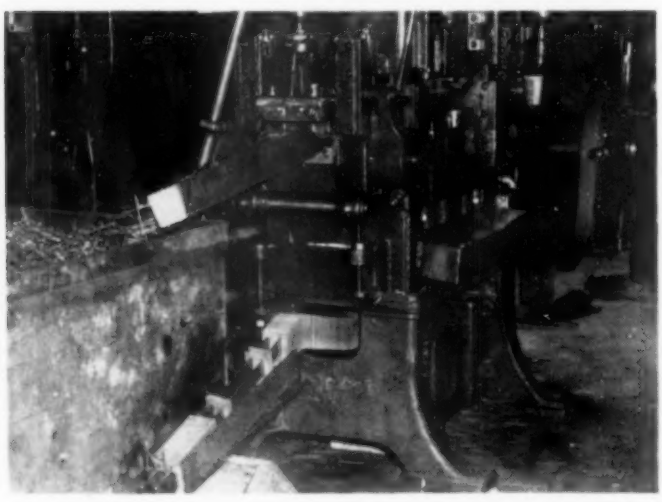
To assure a smooth flow of materials through a proces and from operation to operation, it is imperative that th tooling, work stations, and materials handling be so eng neered to insure complete coordination.

The ultimate, of course, in materials handling is n handling at all. The nearest approach to this is automat handling and prepositioning between operations, whethe they be machine or work station operations. This feat i usually accomplished by drops, chutes, conveyors, hopper lifts, transfers, etc. In these cases, it is obvious that th tooling should be as nearly automatically loaded or un loaded as possible.

In the case of less active products, where the handlin is not automatic, correlation of the loading, positioning, an unloading is too often overlooked in the designing of too and work stations. In such cases, it is surprising how man features that are normally considered only on fully auto matic handling can be used at least in part of this type o activity.

We shall try to illustrate, by example, several types o materials handling which the tool engineer should consider a he plans the manufacture of his product. In these illustra tions, we do not have in mind so much the mass productio products as we do a diversified type of manufacturing, al though in diversified manufacturing there are many item which are, in themselves, made in large quantities and must have the same consideration given any other mass produce product.

Figs. 1 and 2 shows two adaptations of the same idea o prepositioning materials from an automatic set-up for th



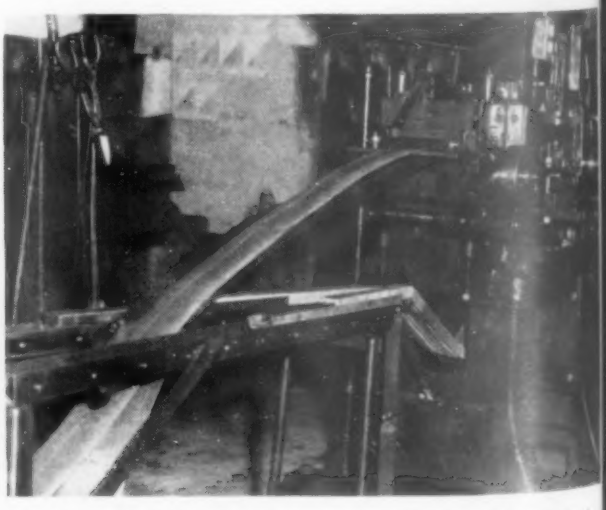


Fig. 1 (left) and Fig. 2 (right) illustrate prepositioning of material into the press. Material is reel stock, and is fed into progressive dies. Sheetmetal channel permits carrying of punchings out of die for lay-aside.

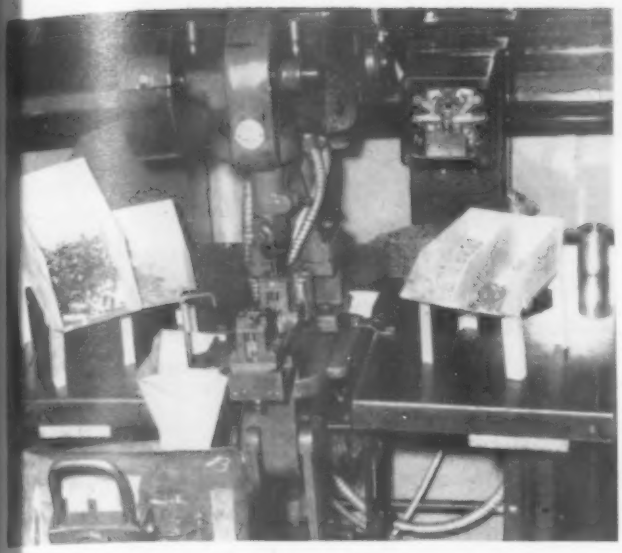


Fig. 3. Two-position rotating fixture here allows operator to load one fixture while work is being performed on the other.

Fig. 4. Joining of a silver contact button to a contact arm is facilitated here by a work station built around a welder.

next operation. In both cases, reel stock is automatically fed through progressive dies, with the "E" punchings being discharged through the bottom of the die. As the punchings come out of the die, they are carried away by means of a suitable rod arrangement to a convenient place for their lay-aside operation. The combining of the preposition for the next operation and the lay-aside operation is accomplished by the use of a sheet metal channel large enough to accommodate the punchings. This channel is placed under the path of the punchings, allowing them to be fed automatically into the channel. When the channel is filled, the channel and the punchings are slipped over the end of the rods and replaced by an empty channel. The channels become both a medium for transporting the product, and a part of the work station in the next operation.

The feature of the station shown in Fig. 3 is the two-position rotating fixture which allows the operator to load one fixture while work is being performed on the other. The stack bins are so arranged in this station as to facilitate two-hand positioning of the parts. After the operation is completed, the fixture is swung 180 deg, thus positioning the loaded fixture directly underneath the riveting ram. On the left of the fixture is an arm that extracts the finished part when it is revolved. The part is dropped into a pan located beneath the work table through the medium of a chute.

Fig. 4 illustrates a work station built on and around a resistance welder. The nesting holding fixture is made fast to the bottom electrode. Attached to the right side of this fixture is a shelf or tray, the top of which is the same height as the top of the fixture.

The operation to be performed on this set-up is the joining of a silver contact button to a contact arm. The arms are delivered to the station in the stack bins shown on the left. The silver contacts are delivered to the station in the same small carton as supplied by the vendor. A small quantity of these silver contacts are placed on the shelf, thus prepositioning them for the actual operation. The operation involves selecting a contact bar and placing it in the fixture with the left hand, while sliding a silver contact over to its relative position with the right hand. The joining cycle is completed, and discharge from fixture is by means of a drop chute to a container underneath the work station table.

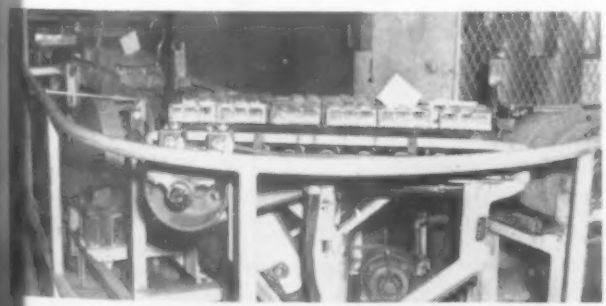


Fig. 5 (top). The 90 deg swing section of power conveyor overcame the problem of lack of space in this operation. Fig. 6 (bottom) shows a double-deck merry-go-round developed to position a sub-assembly for main assembly and at the same time allow for a backlog of parts.

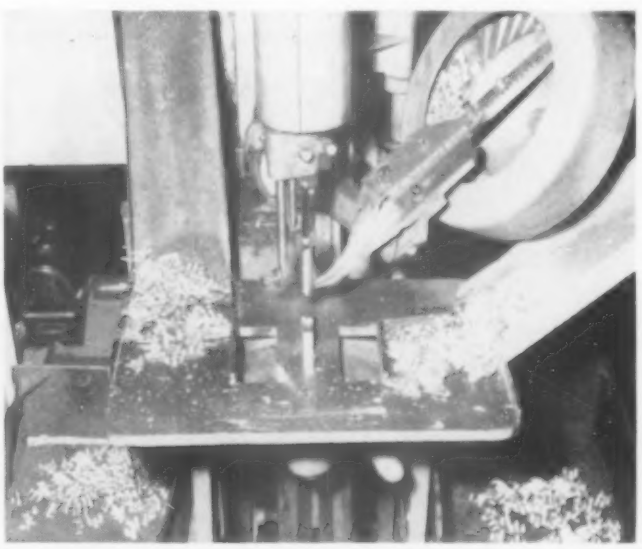


Fig. 7. Two stampings are joined here by a screw. The operation is performed by an automatic screwdriver, around which the work station is constructed. Both items are delivered to the station through hoppers, which are supplied by chutes shown at the left and right of the work station.

A unique arrangement to overcome the lack of space for the installation of conventional conveyor curves of sufficient radius to accommodate the large baskets is shown in Fig. 5. The 90 deg swing section of power conveyor (electrically controlled) shown in the foreground solved this difficulty.

The movements of the feed belt, swing section, and the automatic loading device are all synchronized and timed with the chain conveyor in the dip and bake equipment. In this set-up, the material flows down the feed belt onto the swing section. When the swing section is loaded, both the feed belt and the belt on the swing section are automatically stopped. The swing section then turns 90 deg. If the load mechanism is empty, the belt on the swing section and the load mechanism both go into action, unloading the swing section. The swing section then returns to its original position, that is, in line with the feed belt.

An example of positioning a sub-assembly for a subsequent operation in the main assembly line is shown in Fig. 6. The product, as assembled in the sub-assembly station (shown in the foreground of the picture) is quite delicate, and in order to handle this product efficiently and, at the same time, allow for a backlog at the main assembly station, the double deck merry-go-round apparatus in the center of the picture was devised. The operator in the sub-assembly station, upon completion of the operation, places the product in a vacant nest of the merry-go-round. When the operator in the main assembly line on the opposite side of bench needs one of these parts, the merry-go-round is revolved until the part is accessible.

In Fig. 7 the work station is built around an automatic screw driver. The operation to be performed is the joining of two stampings by driving a screw through one member into the other. The two items to be joined are delivered to the station through hoppers by means of the chutes that are shown on both the right and left sides of the work station. The operation is to pick up an item with each hand and position them on the anvil of the machine. The automatic screw selector positions the screw, after which the machine is put through its cycle. The discharge or lay-aside is by a chute, either to the right or left of the anvil dropping the finished sub-assembly into pans located beneath the table of the work station.

A work station where the area required to perform the operation is quite small, but the materials that are needed are many and quite bulky, is shown in Fig 8. If the conventional thinking had been used in setting up this station, a tremendous amount of walking on the part of the operator, or else a large amount of material transfer, would have been required. With the turn-table shown on the left of the picture, a large amount of material can be located in a comparatively small space. As the operator requires material, the turntable is revolved by means of a foot treadle positioning the material within reach of the operator. The cartons on the turn-table are the original shipping containers.

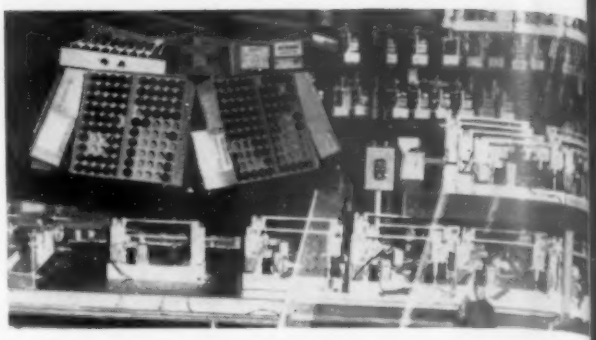


Fig. 8. This operation is an example of a station where required area is small, but where needed materials are many and bulky. The turntable is rotated by a foot treadle.

One type of unit loading for the movement of material to a sub-assembly work station in relatively large quantities is illustrated in Fig 9. The parts as made in detail are placed and stored in these pans prior to assembly. This method allows the material to be brought to the station in either a day's supply or an economical run. Small parts, where several are required for each assembly, are usually transferred from the trays to stack bins located near the fixture. The larger parts, particularly if only one is required per assembly, are taken individually from the trays. This type of operation is especially adapted to work stations where the operation is not continuous and where it is necessary to make frequent changes in the work station layout.

Fig. 10 is an example of a work station designed with the control of parts as one of the deciding factors. It should be noted that in each try of the rackbin shown on the right there is a complete complement of parts to produce a finished product with the exception of hardware and small common parts which are stored in the rack bin on the right side of the bench. The parts are positioned in the trays by the storeroom attendant. The assembly fixture has a rotating base that was designed with this type of picking in mind. After the product is assembled, it is released from the fixture and discharged onto a roller conveyor which delivers the part to its wiring station.

Fig. 9. Parts shown here are stored in boxes for shipment in a reasonably large quantity to the needed point. This is particularly effective for batch production.

Fig. 10. Control of parts was one of the deciding factors in this materials handling layout. Each tray carries a complete assortment of parts to complete an assembly.

Practice and Applications of Production Machines and Tools

By Orlan W. Boston

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THE RESULTS OF SCIENTIFIC research in laboratories and in practice continuously reach the production lines. This applies to the conditioning of the metal being machined and the type and application of cutting fluids as well as to the cutting tools themselves. One of the outstanding achievements made manifest by practice in the large manufacturing plants during the past two years is the increased use of transfer machines. In the past the economic efficiency of these large, expensive machines has been questionable in many instances because the downtime required for changing broken or dull tools has been excessive. Through more scientific knowledge of the selection, treatment, grinding and application of the tools together with the more appropriate speeds and feeds, these tools are producing more per tool grind with greater uniformity in performance. Further development in the application of location of tools and toolholders has been made so that worn tools can be replaced in a very short time with practically no change in dimensions of the work. It is increasingly important that these expensive machines be made more flexible so that changes in speeds and feeds can be made to keep abreast of new developments in material and tools.

During the year many sessions of technical societies have been devoted to reports on basic facts relating to the performance of tools, cutting fluids and materials cut. Much has been accomplished in the standardization of types and sizes of tools. The machine designer has taken advantage of this scientific information in designing his machines for maximum production both from a power point of view and the endurance of tools, uniformity of surface finish and dimensions and the reduction of direct labor, which leads to lower final cost.

More attention is being given by management to the inspection of work while it is in the process of production through the use of various methods of quality control. By using methods of inspection, which determine slight variations in dimensions or conditions becoming excessive and outside of the tolerances permitted, the manufacturing operations can be maintained to reduce the downtime and minimize the expense of defective work.

Most of the improvements recently demonstrated deal more with the machine tool itself than with the cutting tools, and the higher production at lower unit cost is accomplished by the new machine tools through better practice of applying our present knowledge of cutting tools, rather than by any outstanding improvement in the cutting tools themselves. The new machine tools would make it possible to operate at more appropriate speeds and feeds for all metals and cutters. The better grinding of tools to correct shape and the better application of cutting fluids assist greatly in this more economical production.

Some of the principal improvements in machine tool design include:

1. Increased weight with greater rigidity.
2. In general, higher spindle speeds and the wider application of speeds in infinite steps.
3. The broader application of attachments to do more work at one chucking. These apply particularly to the automatic screw and chucking machines but are also evident in the multiple-way drilling machines and heavier milling machines.
4. Live tail centers on lathes and in arbor supports of milling machines to accommodate the higher work and cutter speeds are in more general use.
5. The use of flywheels is emphasized as being advantageous to smooth cutting since many of the milling machines are now provided with built-in flywheels on the spindle.
6. One company has introduced vibration dampeners in the over-arms of their milling machines and these are claimed to make possible certain operations which might otherwise be objectionable because of chatter.
7. A cylindrical grinder has been introduced to the trade for the first time with a spindle balancing device which, with one lever, is made to balance dynamically the wheel and spindle in "less time than it takes to tell it."
8. Some screw machines are provided with pneumatic or hydraulic bar feeds. A large universal turret lathe has a new hydraulic bar feed and collet chuck. Another bar feed attachment is supported from the

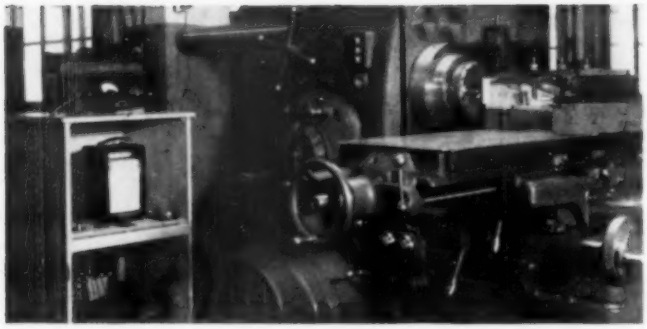


Fig. 1. General view of a milling set-up for determining gross and net power, tool wear and other factors for various metals when in-cut and out-cut milled.

ceiling by chain rather than on stands from the floor. A reduction of 75 percent and more in noise is claimed.

9. The lubrication of machine tools is more automatic. Force feed and splash lubrication are used for gears, bearings, sliding splines, etc., while sliding or reciprocating ways are well protected from chips and dirt and are force-lubricated with filtered oil through metering units. The manual or mechanically operated "shot" system is used on many machines.

10. Electric motors of greater power are used to accommodate the removal of more cubic inches of metal per minute. One series of milling machines is provided with "dual motors," that is, a motor of two ratings, one of low capacity for low speeds and another of double capacity for the higher range of speeds required for sintered carbide cutters.

    An axial air gap motor, having a length of about one-half and a weight of about two-thirds that of a conventional motor of the same power and speed rating, has been introduced. The motor may be used either horizontally or vertically by changing only the cover. With its reduced overhang, the axial air gap motor is particularly suited to flange mounting directly to the driving shaft of the machine.

11. Improved electric and hydraulic equipment leads to easier maintenance and greater safety.

12. The use of hydraulics for driving the rams of drawing and powdered-metal presses, the slides of plastic-moulding and die-casting machines, the heads of drilling and honing machines, the tables of planers and shapers, and for providing the feeds of a wide variety of machine tools, continues to be popular. Hydraulic devices are now built in units which consist essentially of a hydraulic pump, oil reservoir and check, pressure and flow-control valves, all combined in one package. In this way piping is reduced to a minimum and is concealed. Hydraulic circuits are accessible for adjustment and better maintenance. Many of these hydraulic devices are controlled electrically and are interlocked for safety, when several stations such as a ram, clamp or fixtures are used jointly. One cylindrical grinder, provided with hydraulic feed to the table, is so arranged that when the table is not in motion, an automatic by-pass opens to discharge the oil from the positive delivery pump back to the tank. This eliminates pumping against the high pressure of the relief valve. Less power is consumed and the oil remains cooler. The recent standards of the Joint Industry Conference (JIC) are of great help to the designer and user of hydraulic equipment.

13. Voltage control drive, using motor-generator, ex citer, and controller, has been improved. Th are more applications of the dc driving motor co trolled by electronic rectification which repla the motor generator and exciter. Both the sm tool room lathe and turret lathe of one manufa turer have replaced former Ward-Leonard dri by electronic control, so that automatic spe changes preselected for as many as 9 stations, to gether with automatic electronic feed changes ma be pre-selected for as many as 6 stations. Th speed range of this lathe is from 50 to 5000 rp and the feed range from ½ to 16 ipm. A larg engine lathe employs electronic control to give constant cutting speed for any diameter of wor This makes it possible to maintain a desired cutti speed with the resultant constant surface quali on work of variable diameter. This was of gre importance on the finishing of work of varyin diameter, such as the noses of high explosive shel Another large electric-cycle turret lathe ha electronic control for changing the speed and fe to the desired value as each tool is presented t the work. An electronic-mechanical feed unit sa to be positive in performance and flexible for set-u purposes is being used on special machines ha drilling and reaming. In this case, as electronicall controlled variable speed motor drives through a mechanical transmission.

A semi-automatic heavy duty turret lathe of small siz was introduced which has electric-pneumatic control o speed and feed changes and rapid traverse. It is claimed tha this arrangement leads to very close timing and saves a con siderable amount of time in making the production set-up.

An unusual number of profile or contour duplicating ma chines has been developed. They are operated mechanicall electrically, hydraulically and pneumatically and have bee

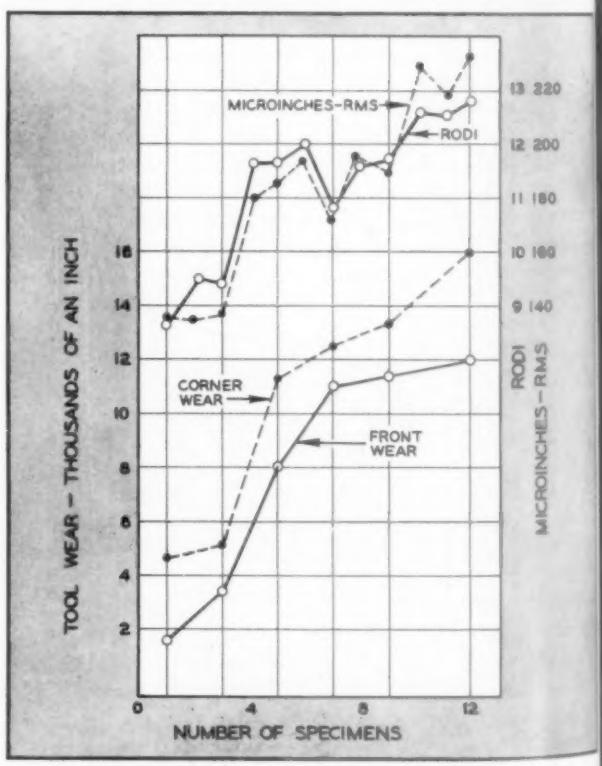


Fig. 2. Correlation of surface quality on the work and the width of the flank abrasion on the front and corner of an end-cutting forming tool, of high speed steel, as indicated by Profilometer average reading in microinches, rms, and the RODI gage units. An alloy steel was formed at 137 fpm with an in-feed of 0.00085 ipr. Back rake was 12 deg.

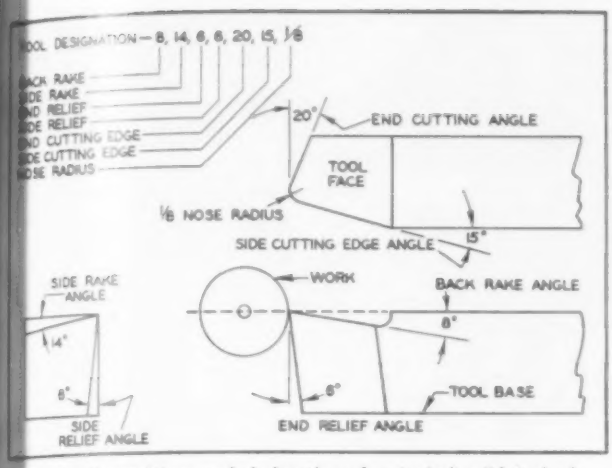


Fig. 3. Nomenclature and designation of a typical solid tool of high speed steel, ground for rough turning steel of about 250 to 300 Bhn.

applied to turning and milling. These machines will do much toward lowering the costs of dies, molds, shafts and other intricately shaped parts.

For the first time a device (Proficord) has been demonstrated to the public for measuring and recording rough machined surfaces. This provides a magnified chart of shape, height and spacing of surface irregularities and brings the question of feed marks into the picture. It is of greater importance to the machine shop than the instruments which formerly measured roughness of a low order at high magnifications. Blocks carefully prepared with gradient lines of various pitches are expected to play an important part in standardizing surface quality.

Cutting fluids used on the various machines emphasize properties somewhat as follows: high cooling capacity, little or no fire hazard, no skin irritants, long-lasting rust inhibitor, permanently pleasant odor, resistance to becoming rancid, nonfoaming and some degree of transparency; and the emulsions, particularly those which may be used on a wide range of work, are made up readily with most hard waters. This phase of metal cutting; the cooling and lubrication of metal cutting tools, with proper consideration to the operator, the work, and the machine tool, is receiving more and more attention. The application of cutting fluids in large quantities at or near room temperatures is becoming common practice. Settling tanks, filters, magnetic chip separators to maintain the cutting fluid in good operating condition are provided on many of the grinding and honing machines. Greatly improved induced draft air cleaners are available.

Sintered carbides are in more general use for drilling, reaming, as well as in turning and milling; they operate successfully even in hobs and gear-shaper cutters. The application of carbides has led to great increases in horsepower requirements because of the greater cutting speeds. Carbide tools have operated on a shaper at speeds of approximately 200 fpm with apparently no chipping of the tips in evidence. This reduces the floor to floor production time and puts greater emphasis on the handling, loading, and clamping of the work. This explains why so much attention is being paid to the reduction in handling time, the quick changing of speeds, and the accurate and quick adjustment of cutting tools when reground. The present trend is definitely toward automatic loading and unloading, clamping, speed changing, and much of tomorrow's production increases and cost reduction will come as a result of more efficient handling devices.

Sintered carbide tips and tipped tools are now a part of the JIC and ASA standards. The solid cylindrical, square and triangular tangential bits are now being added to the ASA standard as they are being used more and more.

Many examples are available which show that the work of several machines could be done by only one if the proper setup were made. The cost of these tools, fixtures, cutting fluids etc., is nearly always much less than that of the machine tool and yet it determines the output of the tool. This indicates that these accessories and their application deserve a great deal of attention. This becomes particularly acute if the new machines have all the improvements we expect and, as a result, are high in cost.

What are the improvements in cutting tools which will keep their productivity in line with the new machines? Until a sintered carbide with a higher tensile strength and greater ductility is developed for general use, better performance seems to be possible chiefly through the improvement in rigidity, tool shape, speed of cut, ratio of cut (depth to feed), and the quick and accurate replaceability of the worn tip in the holder. Research on cutter and machine performance is being continually carried out. Fig. 1 is a general view of a milling-machine setup for determining gross and net power, tool wear, and surface quality, as tool shape, number of teeth, diameter of cutter, size and width of cut, and fly wheel action for various metals machined when in-cut and out-cut milled. A single bit is shown mounted in the cutter body, in turn attached to the face of the flywheel. An end view of the test bar mounted in the rigid welded fixture is shown on the table. The profilometer and recording wattmeter with transformers for the spindle and feed motors are shown at the left. A toolmaker's microscope and camera are available for determining and recording the wear on the tools. Only minor improvements in the carbides are looked for, but their application as mentioned above offers opportunities to challenge the improvements inherent in the machine.

Table I shows some typical data when milling a cast iron with a sintered-carbide-tipped face mill. The unit horsepower at the cutter per cubic inch of metal cut per minute (hp_c/cu. in. per min.) is practically constant for all depths and all speeds as long as the feed is constant. It is, however, reduced from .61 to .50 to .41 to .34 as the feed per tooth is increased from 0.0025 to 0.005 to 0.010 to 0.020 inch, respectively.

TABLE I—UNIT POWER BASED ON NET POWER AT CUTTER as a Function of Feed per Tooth, Depth of Cut, and Cutting Speed when Face Milling the 4-inch-wide Face of 18,000 psi (170 B) Cast Iron with a 9 inch diameter Face Mill with 16 Teeth Tipped with K2S Sintered Carbide and Ground to a Shape of +7, +4, 6, 6, 2, 0, .070" at 45°. A new 5HM, Kearney and Trecker Corp., Plain Horizontal Milling Machine was Used.

d Depth of Cut Inches	Cutting Speed FPM	Hpc / Cu. In. per Min.	Cu. In. per Min. / Hpc	Hpc / Cu. In. per Min.	Cu. In. per Min. / Hpc	Hpc / Cu. In. per Min.	Cu. In. per Min. / Hpc	Hpc / Cu. In. per Min.	Cu. In. per Min. / Hpc
⅛ to ½	100 to 800	.61 to .60	1.64 to 1.67	.50 to .49	2.0 to 2.04	.41 to .40	2.44 to 2.50	.34 to .33	3.00 to 3.03
		.0025		.005		.010		0.20	

f, Feed Per Tooth, Inches

$Hpc/\text{cu. in. per min.} = 0.113\ f^{0.29}\ d^{0}\ V^{0.01} = 0.113/f^{0.29}$

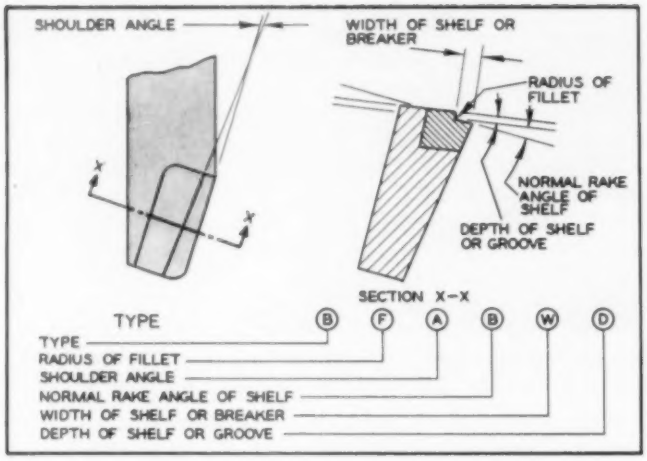


Fig. 4. Sketch of an angular, shelf-type of chip breaker in a carbide-tipped tool.

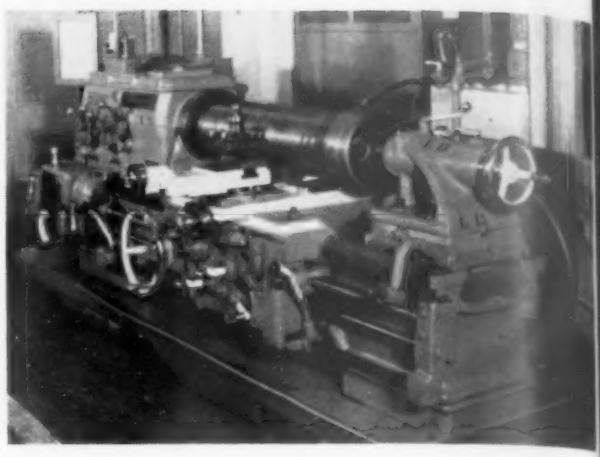


Fig. 5. Machine set-up for studying turning problems on various metal analyses, using different cutting tool designs.

Where size cut is limited, multiple tooling may be resorted to in order to absorb the power available. The greater rigidity of milling machines will permit more general use of the more productive in-cutting milling. Rakes of sintered carbide tools for cutting materials giving discontinuous chips for brass and cast iron (also the light metals) are found to give the highest-speed tool-life constant for positive values of 3 to 8 deg, while steel performs best with negative rakes of 5 to 10 deg. The Kearney and Trecker face mill with solid blades of sintered carbide ground with a ridge back of the cutting edge at negative 5 to 9 deg rake with a width of 1½ times the feed, backed by a positive rake of from 15 to 30 deg, provides a lip angle greater than 90 deg to accommodate the carbide of high compressive strength but low ductility, and yet allows the chip to flow freely over the built-up edge supported on the ridge. Negative rake angles are definitely beneficial for intermittent cuts to prevent chipping of the cutting edge. At the start of each cut the impact of the work falls on the face of the carbide tool back of the cutting edge rather than on the cutting edge itself.

Sintered carbide tools must be operated at speeds two or three times those used for high speed steel tools, to avoid the chipping of the cutting edge. At speeds below 200 to 250 fpm chipping is probable and the tool life will be less than at higher speeds of 300 to 600 fpm. Cutting fluids are used on carbide tools only when a large supply can be directed on the continuously cutting tool. For intermittent cuts in turning or in milling, cutting fluids are deleterious and reduce tool life. The intermittent cooling causes frequent wide temperature changes and the carbide will develop cracks (heat checks) at right angles to the cutting edge. These cracks lead to chipping. Light feeds of less than 0.003 in. per tooth cause chipping and feeds of 0.005 in. to 0.012 in. are more satisfactory.

Sintered carbide tools normally fail by cupping and flank abrasion in all machine operations. Several researches concluded that a flank wear of 0.030 in. width below the cutting edge was sufficient to justify regrinding and therefore can be considered a fair commercial tool life. At this point the temperature of cutting and the power developed have increased. The wear should occur on the work-shoulder flank rather than the nose flank as the latter will cause a change in dimensional accuracy and surface finish. In precision turning and boring, dimensional changes of only 0.0001 or 0.0002 in. could normally be allowed before exceeding the tolerances on the work piece. The amount of flank wear on the end of a ½ in. wide high speed steel forming tool as it was fed radially inward, is shown in Fig. 2 to increase with the number of specimens. The corner wear is also indicated as this tool action corresponded to that of a wide cut-off tool. The surface quality of the tool was about 6 microinches rms. The surface on the work produced for each of the amounts of flank wear is shown as the wear progressed, at the top of Fig. 2. This surface was about 135 microinches, rms, for the first piece but increased to about 220 for the twelfth piece.

TABLE II—TORQUE, THRUST, AND POWER IN DRILLING an Annealed Chrome-Vanadium Steel, SAE 6150, and a Soft Cast Iron, using an Emulsion of 1 Part Soluble Oil to 16 Parts Water.*

Drill Dia. In. *d*	Actual R.P.M. *N*	Feed, In. per Rev. *f*	Torque, Lb.-Ft. *T*		Torque Horse-power, Hp *T*	Thrust, Lb. *B*		Thrust Horse-power, Hp *B*	Total Output, Hp.	Input, Kw. from Wattmeter			Net Input, Hp.	Efficiency Per-cent
			Test	Formula		Test	Formula			Gross	Tare	Net		
Test Results on Steel, SAE 6150 Steel														
½	444.5	0.009	14.0	13.43	1.185	725	678	0.00732	1.193	1.6	0.67	0.93	1.244	96
⅝	368.0	0.011	22.3	23.4	1.562	838	990	0.00856	1.571	2.025	0.67	1.355	1.815	87
¾	299.7	0.012	34.3	34.8	1.957	1,269	1,273	0.01153	1.975	2.42	0.67	1.75	2.34	84
1	228.1	0.013	62.4	62.4	2.71	1,862	1,820	0.01394	2.724	3.176	0.57	2.606	3.49	78
1¼	175.1	0.015	110.8	104.0	3.694	2,430	2,520	0.01611	3.710	3.87	0.57	3.3	4.42	84
1½	149.0	0.015	143.3	144.0	4.07	3,000	3,020	0.01693	4.087	4.507	0.507	4.0	5.35	76
Test Results on Cast Iron														
½	446.0	0.009	6.3	5.6	0.535	530	436	0.00614	0.541	1.12	0.67	0.45	0.602	90
⅝	364.4	0.011	10.2	9.9	0.708	645	615	0.00652	0.715	1.32	0.67	0.65	0.870	82
¾	299.7	0.012	15.7	15.05	0.896	803	778	0.00728	0.903	1.48	0.67	0.81	1.084	83
1	229.8	0.013	27.9	28.1	1.221	1,088	1,088	0.00822	1.23	1.72	0.50	1.22	1.635	75
1¼	179.4	0.015	46.4	47.8	1.585	1,403	1,481	0.00954	1.60	2.025	0.45	1.575	2.110	76
1½	153.4	0.015	65.9	68.7	1.925	1,700	1,778	0.00988	1.94	2.27	0.37	1.90	2.550	76

*Standard twist drills were used with 31-deg. helix angle, 121-deg. point angle, 136-deg. chisel-edge angle, and 5-deg. relief angle. The ratio of web thickness to diameter was 0.14 for the ¾ in. and larger drills, 0.162 for the ½-in-dia. drills, and 0.185 for drills up to ⅜ in. dia. Speed 60 f.p.m.

A solid high speed steel single-point tool with nomenclature and a key for designating angles is shown in Fig. 3. The angular shelf-type of chip breaker is shown in a carbide-tipped tool in Fig. 4. The angle *A* is zero if the tool is used for cuts of variable depth. For shallow cuts angle *A* may be as high as 45 deg to prevent the end of the shoulder from forming the machined surface. Ridge- or groove-type chip breakers are also used on carbide tools, but less carbide must be ground away to leave the ridge to support the built-up edge.

The tips are brazed on the top face of the shank with only side, or no shoulder, as less tip breakage occurs with this procedure. Tips are brazed to the face of a bit in turn clamped interchangeably to a shank. Tips are clamped mechanically to the shank, the clamping plate serving as a chip breaker. Solid square-sectioned bits will be clamped in tool holders at a low back rake angle so that only the end of the bit is ground for resharpening. Solid cylindrical bits of a diameter corresponding to a desired nose radius, as well as solid bits of other shapes, are being used, clamped in the end of a shank so it is tangential to the work and the ground end of the bit forms the tool face. This end may be ground with the conventional shelf-type chip breaker or concave to form a rake, leaving a narrow flat ridge equal to 1 to 1½ times the feed, just inside the cutting edge. A set-up for studying turning problems is shown in Fig. 5.

Considerable improvement in turning-tool holders, as a part of the machine tool, has been made. These should hold the tool shank more rigidly in the proper fixed position to the work and make it possible to replace tools quickly and accurately. In large production machines, the whole tool post, with its set of tools, may be taken from the machine to be replaced quickly by another, containing its tools, properly reconditioned in the grinding room. All tools can in this way be set to correct position by gages before being placed on the machine.

The use of high cutting speeds to secure good surface quality is increasing. Diamonds or sintered carbide must be used to withstand these high speeds at light depths. Thread chasers of carbide are being used successfully on steel according to a number of recent reports. The nose radius or flat on the end of turning and face-milling cutters must be coordinated with the feed to eliminate the tool feed marks.

Fig. 6. Some of the research equipment used at the University of Michigan for investigation of various alloys in service.

Marked improvements have been made in some of the cast tungsten-cobalt-chromium alloys. The new metal may be used for heavy feeds and cuts on steel as well as on brass, bronze, cast iron and hard rubber. These tools yield results between those of high speed steel and sintered carbide.

A new high-cobalt high speed steel is now heat treated to give a hardness and performance well above those of the usual high speed steels. Limited reports of an outstanding nature have resulted. The high speed steels are still the backbone of production, as they are strong, less temperamental in performance, and when used with proper cutting fluids, are consistent ground gainers. The new, more powerful machines will probably be tooled with these types for most jobs of drilling, reaming, recessing, spot facing, etc. Research equipment for studying tools of this type is shown in Fig. 6 and typical results for drilling are shown in Table II.

Not so much has been heard lately of the extended use of the many so-called surface treatments to improve the performance of high speed steel tools. A number of them are being used currently with good results for specific purposes. These consist of nitriding, flash-chromium plating, oxide coating, liquid honing or vapor blasting, and peening with steel shot.

It requires about 0.4 hp at the cutter or 0.8 hp at the motor to remove each cubic inch of cast iron. With larger motors on the new machines it seems logical to expect more multiple tooling or heavier cuts or higher speeds. The total power at the motor equals the horsepower per cubic inch per minute at the motor times the cubic inches removed per minute. For magnesium the power at the motor per cubic inch per minute is about 0.3, for aluminum 0.5 and for steel from 0.8 to 1.2. These values are changed but little with or without application of cutting fluids or with variation in cutting speed. They will be higher, however, if the feed is reduced to give thinner chips and reduced for heavier feeds.

In those machining operations in which very thin chips are removed, the unit power at the motor is very high, for example 5 to 15 for finish broaching steel, 15 to 30 for band sawing steel, and 20 to 50 for grinding steel. With the large metal removal the problem of chip disposal becomes important.

Cutting tool grinders should have a conspicuous place in this category, as with tools improperly shaped and finished the new machines could not produce as intended. Emphasis is placed on machine-grinding cutters to produce geometrical accuracy and a fine surface quality of 1 to 15 microinches.

Diamond abrasive wheels are being used increasingly to finish carbide tools. These wheels are made in several grades of resinoid, vitrified and metal bonds, each with diamond grit sizes from 60 to 500. The vitrified bonded diamond wheel is now proving superior to the others. For wet rough grinding, grits of 80 to 100 are recommended, such as D100-L100 V 1/16, or a silicon carbide abrasive wheel of 60 grit in a medium soft grade, such as C60-17V. For wet finishing, diamond wheels of 80 to 220 grit or finer, such as D220-N100V 1/8 are used, or silicon carbide wheels of 100 or 120 grit of medium soft grade.

A coolant or oil should be used with these diamond wheels to keep them cutting freely and to prevent the tools being overheated. In regrinding carbide tools it is imperative that all cracks and flaws be completely removed.

For sharpening the cast nonferrous high speed and carbon steel tools, the aluminum oxide, free-cutting, wheels such as A54-K5VBE, or equivalent, are used. Again, correct form, keen cutting edges and smooth surfaces are of the greatest importance for satisfactory tool performance.

Recent Trends in Turning and Boring

By George L. Kluter

WORKS ENGINEER

THE WARNER & SWASEY COMPANY

One of the most significant trends in turning and boring is that toward the more and more universal application of the "transfer principle" in the design of machinery for this field.

The transfer principle in this case is not taken in its usual sense, which merely implies that work is mechanically transferred between stations or machines. Instead, the transfer principle is taken to mean that as many as possible of the operators functions are *transferred* to the machine.

The turret lathe itself is a good example of this principle, as the machine's primary function is to relieve the operator of virtually all the work of changing tools in sequential operations.

That the turret lathe, which was introduced some 100 years ago, can be cited as an example of transferring functions is proof that the principle is not a new one. Nevertheless, intensified application over the recent past marks this broad trend as one of the most important in the field.

As spectacular examples of developments in this direction, two machines at work for the past two years in the Oldsmobile-Lansing plant might be cited. Here extremely high volume and purely repetitive work made practical the development of such specialized equipment as a single machine 86 feet long, where one operator controls 18 work stations. Another puts 90 tools to work on 17 blocks at a time in progressive operations.

Large production volume in a number of fields means that such push-button production line machines may gradually move out of the "curiosity" classification, and increasing numbers of them will eventually assume an important role in production.

Yet there remains a broad segment of metal working where such specialized equipment is just not economically feasible. A good deal of our physical output represents production runs of smaller quantities of pieces which may vary in their detail from lot to lot or from month to month.

But there have been new developments all along the line which apply the transfer idea to units suited to virtually all types of production. Modifications of standard machines and new functions built into such machines have as their purpose the transferral of varying amounts of what we would normally consider the operator's work to speed output and cut costs.

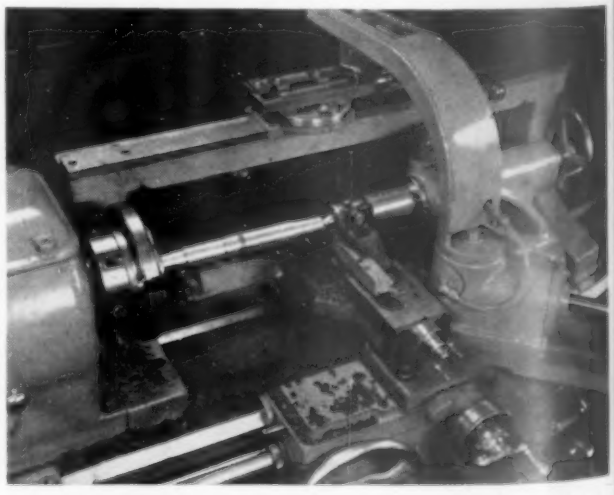
The various types of tracer-controlled lathes which have come into extensive use turn a complicated stepped or contoured piece without requiring anything more of the operator than loading the work and initiating the cycle. These are only special-purpose machines to the extent that they are applied to a specific class of work.

A simple change of template is all that is needed to change the job characteristics.

Another type of control has been applied to movable tool machines to provide automatic tool location, eliminating manual control and jigging by the operator, and here again we have a standard machine modified to take over functions of the operator to speed output.

Other new attachments and functions operate on even more specialized segments of the operator's routine to expedite the work cycle.

Just as speed changing, for example, has shifted from belts to gears, and from gears to fewer gears, we now find gear



Locomotive link pins are turned in 31 seconds on this engine lathe equipped with automatic tracing mechanism.

changing giving way to mechanical preselection, electric speed control and electronic program systems. Feed changing is moving in the same general direction, with fewer levers on hand-operated machines, or with complete preset control.

Work loading is also being speeded by mechanical pacing, with hydraulics, pneumatics or mechanics provided such aids as power holding, chucking and collet actuation, automatic bar feeds, and so on.

Even such factors as accessibility of machine controls and maneuverability of machine elements have come in for close attention. If, by linkage, the controls can be conveniently grouped, for example, the machine assumes the operator's reach and cuts machine handling time to shorten the overall cycle. Refinements in control (zonal control) combination and elimination of controls, power actuation, and even improvement of types and shapes of handles and buttons means that the newer machines are easier to operate in spite of being bigger and heavier.

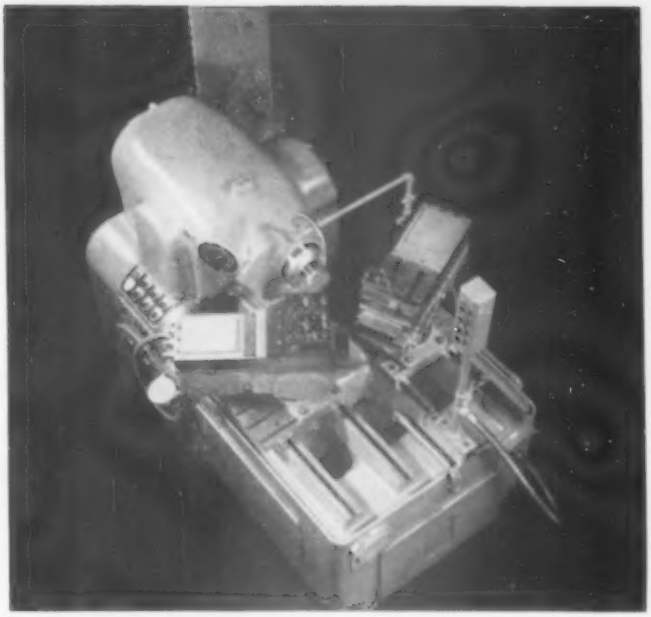
Thus the transfer principle is the guiding factor in machine and tool design, to arrive at more and better output by letting the machine assume as much of the work as possible. Virtually all of the newer equipment in the turning and boring field reflects this view of mechanical pacing to some degree.

It is indeed the prime function of the tool engineer to determine just how far the transfer idea can be applied within a given set of limiting circumstances surrounding the job to be done.

That this procedure is becoming the rule is evidenced by another obvious trend in the field, which is that of a more mature selection on the part of the user among the many types and modifications which did not exist before the war. Plants which showed little interest a decade ago in venturing off the "beaten path" of conventional machines and tooling now are showing keen interest in getting the precise machine to do a certain job the best.

Precision boring and turning machines—in only limited use before the war—are now widely applied on the production line doing work formerly split between a lathe and a grinder, for example. As a result, where precise location, parallelism, concentricity and finish are required, these machines are doing an important job at lower cost.

The high-speed, small automatic lathe is seeing good use where simple operations are required in large quantities with heavy emphasis on cost. Here, rather than taking work over



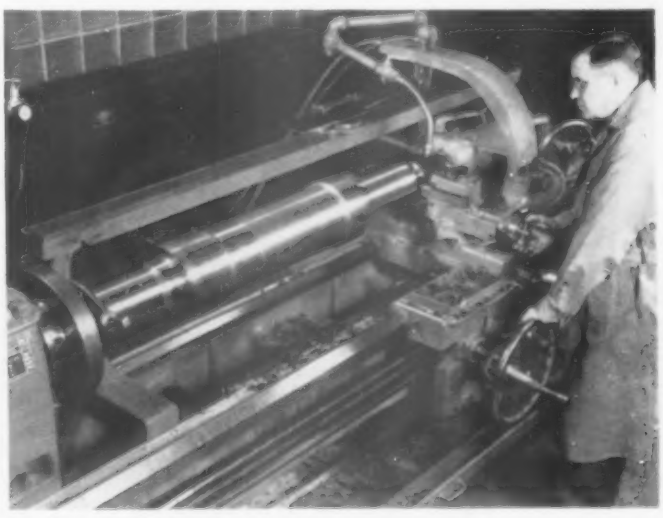
More careful attention to location and design of controls for turning machines has increased production while decreasing operator fatigue.

from several machines, a series of operations formerly done on a single machine may be split among a group of small automatics. In either case, better output at lower cost is the goal, and a strictly postwar brand of resourceful planning was required to effect the change.

More multi-station chuckers are going to work, too, to handle larger volumes more efficiently. Specially-built machines are more common, and better attention to high-production tooling is the rule.

The net effect of transfer improvements on the part of the machine designers and more flexible thinking on the part of machine users has been to break down the conventional classifications for equipment in this field. Simpler machines are being modified for increased production, and elements of more complex designs are being adapted to special and in-between equipment types to fill gaps on the production line. As a result such traditional boundary lines as "manual," "semi-automatic," and "full-automatic" are evaporating, so that the user may fit equipment to the job more closely than ever before.

Gear changing in turning machines is giving way rapidly to mechanical speed selection and electric speed control.



Another application of tracer control on a lathe. The operator merely loads the work and initiates the cycle.

Progress in the Production Forge Industry

By Waldemar Naujoks

SPECIAL PROJECTS ENGINEER
LADISH COMPANY

THE END OF WORLD WAR II in 1945 found the production forge industry, in common with the manufacturing industry generally, somewhat bewildered as to the trends for the peacetime future. Since that time, in the five years that have passed, the production forging industry (where forgings are produced on a production basis as commercial duplicates by the use of closed dies) finds that it has returned to a highly competitive position, both within the industry itself and with other competing processes.

Progress in any industry depends, to a large degree, upon competition for its stimulation. The highly competitive position of the closed die forging industry has forced it to seek and find newer and better methods, to develop new techniques, and to use all of its ingenuity to meet the post-war industrial challenge. Further emphasis on the need for better methods is given by the present cost of labor. Only through economies effected by improvements can the industry maintain and improve its position in the metal-working industry. The post-war progress in the closed die forging industry is of direct importance to the tool engineer since he must be in a position to take full advantage of such improvements wherever and whenever they can be applied. Generally, forgings produced on a production basis require a certain amount of machining and processing on a production basis and the tool engineer is concerned with the most economical means of performing such machining or processing operations.

Improvements in production forging practice, from the first inspection of the forging stock or the forge die blocks to the final inspection of the finished closed die forging ready for shipment, are many. Some are general in nature for application in commercial closed die forging practice, and other improvements are more specialized in nature for use in rather narrow limits of die forging applications. Some of the improvements are naturally expected in the progressive forging plants where handling methods are improved as time goes on, furnace designs become better, inspection makes use of long experience to do a better job, and die designs incorporate past experience. Over and above the normal progress, two significant steps forward appear to be the ability to produce much larger closed die forgings than were considered possible a few years ago, and second, the new non-destructive inspection methods that detect and locate internal defects on small and large forged parts.

Large Closed Die Forgings

Not too many years ago, a closed die forging such as a drop forging was considered large when it weighed 500 pounds. The size of the closed die forging has increased steadily in size and weight so that die forgings of 4000 pounds each are accepted as commercial products. It can be said that within the present year closed die forgings weighing 8000 pounds each or perhaps more, will be produced. Such closed die forgings may have lengths up to 10 feet or more. Naturally, where forgings of such size are produced on a production basis, the problem of handling and machining those large pieces falls upon the tool engineer. Tooling for accurate machining, and machine tools capable of handling such sizes and weights must be provided.

The demand for large-sized production forgings has gained impetus from designers who believe that a structural shape made as one piece has advantages over the same structural shape built up of several parts, at least for many service applications. Some basic advantages of the one-piece design may include less weight, continuity of metal to produce more desirable flow lines, elimination of close-fit machining, shrink fitting, welding, bolting or riveting, and greater resistance to failure of fastening methods. There are fewer parts to watch and usually there is less scrap. Naturally some problems develop due to handling a larger mass.

The major obstacle to one-piece design of large parts has been the lack of equipment and experience to make such large die forgings. Today the equipment and experience is available. The advantage of a large single forging over an assembly is apparent to the aviation industry, particularly for use on high-speed modern planes. Continuity of metal flow lines throughout the piece develops increased strength with a reduction in weight, and more strength with less weight is of prime importance in aircraft design. Reduction in the amount of welding, riveting or bolting in airplane assemblies reduces possible focal points for fatigue failures. Machining, fitting, and assembling problems are reduced.

The large forgings can be produced in many of the forging compositions where billets of sufficient size are available.

Inspection Techniques

For many centuries, the standard test for determining the quality of a forging was the ringing of the part. The forging, particularly large forgings, were struck with a hammer and a clear, bell-like sound indicated freedom from flaws while a muffled sound indicated some defect. Inspection methods of a more accurate nature have been developed in more recent years. The most common method of inspection for quality on aircraft forgings before and in the war period was the magnetic particle, or magnaflux inspection and this method is in fairly common use at the present time.

The newest of the inspection methods for the non-destructive inspection and detection of internal flaws makes use of supersonic sound. Examination of large sections for internal faults is accomplished with the use of a supersonic reflectoscope. The unit consists of a pulse generator which produces a radio frequency pulse. The supersonic energy thus generated is transmitted to a quartz crystal where the electrical energy is converted into mechanical vibration. The resulting vibrations are transmitted through the part in the form of a slightly divergent beam which is subject to reflection and dispersion much in the manner of light in transparent media. The reflected vibrations are received by the same crystal and transmitted to an oscilligraph screen, shown in the form of vertical peaks in the wave trace. In the event of an internal flaw, vertical peaks of smaller magnitude occur between the initial pulse and the reflection from the opposite side.

Flaws may be detected in materials with a minimum of 2 inches in thickness, and up to 20 feet in length, depending on the type of material under test. Operation of the reflectoscope is compared frequently with radar. They differ in that the reflectoscope operates at higher frequencies, detects voids rather than solids, and has a range of about 25 feet as compared to an extreme range of about 400 miles for radar.

The reflectoscope has proven extremely useful on parts that involve expensive compositions and considerable processing. Such parts can be inspected for internal flaws before many hours of expensive machining are given to the part, and prevent failures in service when flaws are not detected before the part is put into service.

Forging Techniques

It is difficult, at times, to differentiate between strictly new techniques and improvements to established methods. Perhaps one of the important contributions has been the study of mechanical properties developed by closed dies as compared to the properties obtained by open dies in forging similar shapes. Up to the present time, a forging has been considered a forging, regardless of the method by which it was made. Open die, or flat die forging permits the plastic metal to move in any direction without confinement, while the metal in closed die forging limits the movement to within the confines of the closed dies. The benefits of closed die forging upon the mechanical properties of the forging, particularly in the transverse direction of the flow lines, has been brought out in a paper prepared by Dixon & Foley and published in the Transactions of ASME for February, 1949. In general, improved mechanical strength is gained by the use of closed die forgings and this is of importance where high strength with minimum sections are desired. The important gains in strength are in the resistance to dynamic stresses.

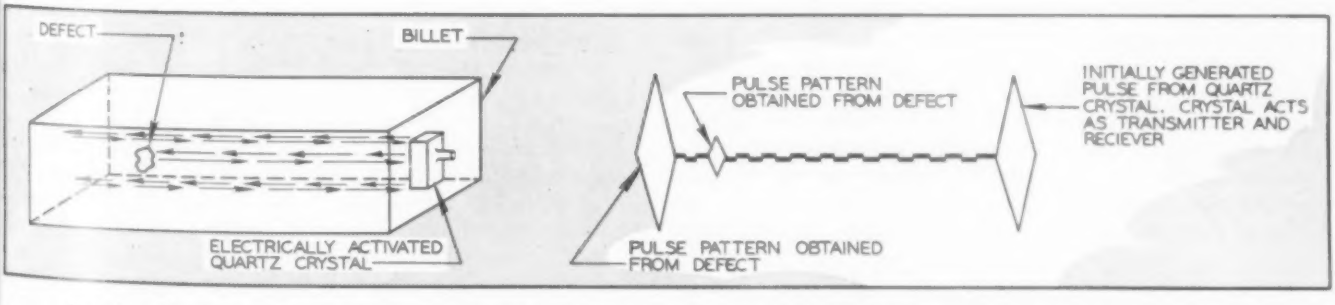
Other advances in forging techniques include the importance of positioning metal flow lines for maximum service properties, development of many forging designs made without draft on outside contours, and improved production techniques.

Recent Forging Materials

Many new forging compositions continue to make their appearance, some to sink back into oblivion and a few to become permanent in the long list of current forging alloys. The most interesting of the new compositions is that of titanium. This metal has a weight about 60 percent of steel and with the same mechanical properties. The tensile strength is about 75,000 psi and the yield point about 60,000 psi in the annealed condition. It is readily forged, at temperatures somewhat lower than steel. Presently it is not available on a commercial basis. Its important property seems to be its great corrosion resistance for many applications.

A significant amount of interest has been shown both during the war and in the period since in the forging of the newer high temperature alloys. Applications of these alloys have become more widespread, particularly in the aviation and power generation fields, and for many stressed parts drop forging offers an effective method of production. Development of forging equipment of higher capacity has paralleled the interest in these alloys.

Considerable progress is being made in the use of aluminum alloys for commercial and industrial purposes. For a long time aluminum alloys were used principally for aircraft applications because of their light weight with high strength. These same factors are instrumental in promoting extensive use of the aluminum alloys in commercial and industrial applications, particularly where weight is an important factor.


DEFECT
BILLET
ELECTRICALLY ACTIVATED QUARTZ CRYSTAL
PULSE PATTERN OBTAINED FROM DEFECT
INITIALLY GENERATED PULSE FROM QUARTZ CRYSTAL. CRYSTAL ACTS AS TRANSMITTER AND RECIEVER
PULSE PATTERN OBTAINED FROM DEFECT

Above is a schematic diagram of the supersonic method of inspecting forgings. The impulse travels through the metal, strikes the flaw, then is reflected back to the quartz crystal which acts as a transmitter and receiver.

Recent Developments in Heat and Corrosion Resistant Coatings for Tools

By Edmund B. Neil*

CONSULTING ENGINEER

THE COATING PROCESSES probably applied most extensively within the past two years, and which show promise of greater use in the near future, are the so-called "hard surface coatings" and certain chemical surface-treatments. The former have been most frequently used to obtain increased wear resistance, and the latter improved corrosion resistance, although these qualities often overlap.

Hard Surfacing

Surfaces of dies and other tools subjected to wear and abrasion are being hard surfaced either by welding the hard material to the surface, or by the electro-deposition of the material. In most cases when the material is welded on, either the gas or electric-arc method may be used. Five hard-facing materials applicable by welding, and the most suitable applications and methods of using them are well described in a previous article (1).** Hot trimmer dies of both carbon and alloy steels, hot-work punches and dies, shear blades, etc., are being successfully surfaced. Selection of the proper facing material depends upon the type of application, such as whether the tool is subjected to thermal shock, or the surface must resist a combination of abrasion and high impact loads. Pre-heating of the surface to which the facing is to be applied is required, but this may usually be accomplished by the torch or electrode. For manganese steel arc welding is preferred to gas (oxy-acetylene) welding. Hardness of the facings ranges from 26 to 54 Rockwell C, as deposited, depending upon the type of material used, which includes those in the chromium-cobalt-tungsten group.

Newest of hard metal coatings applicable by arc-welding procedures is a chromium-carbide powder. The powder is mixed with water to form a paste which adheres to flat and curved surfaces. Use of the powder is recommended where application by means of hard surfacing electrodes is undesirable, such as on thin work, for thin deposits, and for use with ac welders. Hardness of a single-layer deposit ranges from 54 to 61 Rockwell C, and is higher for multiple layers (2).

While the electro-deposition of chromium and other metals and alloys is well known, and various plug, ring and other gages, and other precision measuring tools are readily available with hard surfaces, as well as tools subjected to high pressures and impact stresses, the process would seem to have even greater possibilities than have been adopted to date. This may be due to the fact that the method is often considered as a means of repairing and re-sizing worn tools rather than one applicable to new tools. In the light of recent developments in the electro-plating field, it also seems probable that tool engineers may not have been as fully informed by electro-platers as they should be relative to the advantages of the process and its proper limitations. Failures due to cracking or breaking off of the hard surface material, excessive unevenness of the deposited coating, troubles resulting from efforts to hasten a rather slow normal rate of deposition, difficulty in the satisfactory coating of some portions of the surface, and similar problems, while not entirely overcome, have nevertheless been materially reduced. The electro-plater also must be fully informed as to just what is expected of the coating, as well as of the exact chemical and physical characteristics of the tool material, in order for him to determine the proper plating procedure.

Although space in this review does not permit a detailed discussion of the latest improvements in plating techniques, a few are noted briefly: So-called "specification plating" which can virtually guarantee deposit thicknesses, is possible. Preliminary undercoatings not only of nickel, but of other metals may prove more satisfactory in some cases than direct plating of the hard metal on the steel surface of the tool. However, in such cases it is essential to bear in mind that the chromium is no harder than the surface underneath it, so has proved of little, if any advantage on soft dies. The tool or die must first be made hard, then if properly hard surfaced when new, can be kept in new condition thereafter with only a thin deposit of chromium. Some recent failures have been due to permitting the tool to become badly worn, perhaps penetrating the hard surface, then applying the deposit actually to a softer surface than originally existed.

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**Numbers refer to bibliography at end of article.

The hard, "slippery" and smooth coating obtained with chromium has recently proved a means of improving the finish on plastics produced in compression and injection molds. More extensive applications to hold-down rings on drawing dies, as well as on the dies have been noted. Investigations (3) of the effect of hard chromium plating on the fatigue life of highly stressed parts, places a new light on a long-known problem—that relating to the effect of hydrogen deposited with the chromium. First a decrease, then an increase in fatigue life was noticed with increases in temperatures. Heat treatment to improve corrosion resistance has of course long been recognized (4), but as applied to bright or decorative chromium deposits. The deposition of chromium to a thickness of but 0.00002 in. on plain carbon steels has been shown to increase oxidation resistance to twenty times that of unplated steel at 1550 deg F. When the same thickness is deposited on silicon steel (1.25-1.50 Si, 0.010 C) the oxygen pick-up is only twice that of 430 stainless. Experiments have been conducted to produce a black chromium deposit, but further work is necessary before the process can be considered successful. The electro-deposition of tungsten and of nickel-cobalt alloys on steel, and of chromium on aluminum (where both low weight of the tool and wear resistance, as well as corrosion resistance only, may prove advantageous) also may offer new possibilities. Deposits of porous chromium now frequently used on engine cylinders and on piston rings, by retaining the lubricant in the "pores" of the surface, provide a combination of hardness and self-lubricating characteristics which should improve tools subjected to abrasion and scuffing from lack of sufficient lubrication.

To the foregoing two methods of hard surfacing, the metal spraying (Schoop) process may be added as a rapidly growing third method. As with electro-deposition the process is applicable to tools held at low temperatures, although the procedure to be followed in preparing the initial surface differs from that with plating. Both a production and a "tool" process, numerous non-ferrous alloys, irons, several steels (both low and high carbon), and the stainless variety can be applied for wear or corrosion resistance or for both (5) (6). High carbon, high-chromium and similar steels may be sprayed onto softer steels.

Progress has been made during the past year in spraying steel onto aluminum and magnesium. Both low carbon and stainless steel (18-8) have been sprayed. No alloying of the steel with the light metal occurs, the adherence being mechanical. However, the coating is harder than the original steel, but is porous, so a thickness of 0.04 in. is required for water-tightness. If only a portion of the surface of the light metal is covered, avoidance of an electrolytic couple is obtainable by a strip of sprayed zinc around the line of contact of the steel with the light metal. As with electrolytically deposited porous chromium, the steel deposit offers self-lubricating properties (2).

Chemical Treatments

Many of the older and well-known chemical treatments, and several recently developed, are being applied not only to various products but to tools. In general treatments of this type are primarily for increasing rust and corrosion resistance of the base metal, and to provide a surface suitable for subsequent painting or lacquering, but in some instances they also help to prevent abrasion and scuffing or "pick-up" of the metal where rubbing occurs and lubrication is inadequate. Some of the coatings are deposited electrolytically, while others require dipping procedures only. The electrolytic treatments are usually more effective, although the type of treatment is a factor. The treatments are applicable to both ferrous and non-ferrous metals, the "anodic" treatment probably being the best known for coating aluminum. Current practice in the use of these treatments is well described in two articles appearing during the past year in *The Tool Engineer*, (7) (8) and while referring to production uses, are equally applicable for tool components.

Although the problem of obtaining corrosion resistance by treatments applied to magnesium alloys, which are equal to those now procured on aluminum, has not yet been entirely solved, a previously unsatisfactory selenium treatment seems now to have been improved. Until recently this treatment had poor adhesion, and adversely affected the fatigue life of the material. Since the method involves only a bath dip, it may now be worth further consideration.

Corrosion Resistant and Bright Deposits

While chromium plate is the best known bright or decorative deposit used today, its endurance against corrosive influences is largely dependent upon the under-plate metal. Pitting of the chrome surface can be avoided only by providing a sufficiently thick deposit of copper, nickel or other more highly resistant metal under it. Yet tool manufacturers rightly believing their tools more saleable when certain areas of parts thereof are brightly finished, apparently have in some cases failed to recognize this fact, or for cost reasons have "sacrificed" on the thickness of the underplating necessary for best corrosion resistance. Initially the result appears the same, but a few hours or days under salty, aciduous or other corrosive conditions brings out the inferiority of the thinner deposit under the bright finish. Obviously the corrosion resistant characteristics of the base metal influence the thickness of the undercoating which can economically be applied.

Progress in the development of electro-plating solutions and techniques is now such that the selection of the most desirable protective plate becomes a problem. Improvements in cadmium, zinc and chromium solutions are noteworthy. A recent process produces a nickel plate intermediate between the well-known bright and gray deposits in both hardness and appearance. This particular plate has the ability to fill in imperfections of the base surface so may permit less finishing of unimportant non-precision areas of various tools, or may even serve as an aid in reducing final precision operations on areas normally requiring accurate finishing. Another new solution for bright nickel plating is less expensive and easier to control than normal solutions. It produces a surface that is ductile and little subject to pitting. It also works well on poorly polished surfaces.

Since the plating of metal on plastics may have some applications in the tool field, it may be added that the opposite has been achieved, namely the plating of plastics onto metal. The latter development may eventually find some applications in protecting tools against corrosion and abrasion. Nor should the possibilities of depositing white brass, black molybdenum, black nickel, lead-tin, brass, bronze, silver, and even some of the rare metals such as indium and others, be overlooked in the light of current developments. Each has its characteristics in resisting corrosion and in providing a degree of bright or decorative finish. The war was responsible for stimulating some of the newer platings, and their applications will undoubtedly be extended in the future.

Ceramic Coatings

Largely stimulated by post-war requirements for gas turbines, ceramic coatings are becoming increasingly important where temperature range is above accepted limits for high-alloy materials. While few tools are subjected to sufficiently high temperatures to require corrosion resistant surfaces of the ceramic type, some of the most recent developments in this field may occasionally be found applicable. Incidentally also, porcelain type enamels which can be

applied to steels at lower temperatures than the 1500 deg F and higher, necessary for the application of some coatings, are now undergoing development.

First developed by the National Bureau of Standards during the war for engine exhaust stacks and manifolds, a ceramic coating containing alumina was found best for use up to 1650 deg F after numerous tests with other refractories. Further work since then has shown that a coating (frit) containing 20 per cent zirconia, plus a cover coat of almost pure zirconia, applied as a water suspension by dipping or spraying, and fired at 2150 deg F, has proved satisfactory. Enamels for application to aluminum have also been developed recently. These will withstand some bending and obviously are fired at much lower temperatures than for steel, although the same furnaces may be used as for coating steel.

Organic Coatings

No review of current practice in the coating field would be complete without mention of the many recent developments in organic finishes, especially the synthetics. For the protection of many kinds of tools, either in service or storage, against rust and other corrosive action, numerous new enamels, lacquers and similar finishes have been developed. Some are of the baked-on type, while others require only air-drying after spraying onto the material. Some are also available in colors to provide a decorative effect along with protection of the surfaces. Still others are especially suitable for coating polished surfaces, such as stainless steel and aluminum, and serve to protect the finish on softer metals such as brass and copper. This suggests that they may be used over electroplated coatings of these and similar metals on steel to provide added tarnish resistance where chromium plate may not be desirable.

Several new stripable coatings useful during forming operations, or for shipment and storage of tools, have recently been introduced. These may be sprayed on or applied by brush, and can readily be peeled off. Other new permanent coatings will withstand forming operations without peeling or cracking. Another new coating is suitable for preventing rusting of cast iron or steel parts subjected to temperatures above 1000 deg F. It also is applied by brush or spray, and is understood to contain ceramic substances which form a bond with the metal as soon as the material is raised to flow temperature.

Selection of the most suitable organic coating, its method of application, the correct drying procedure, preceded by the proper cleaning as with any coating process, are all factors of importance.

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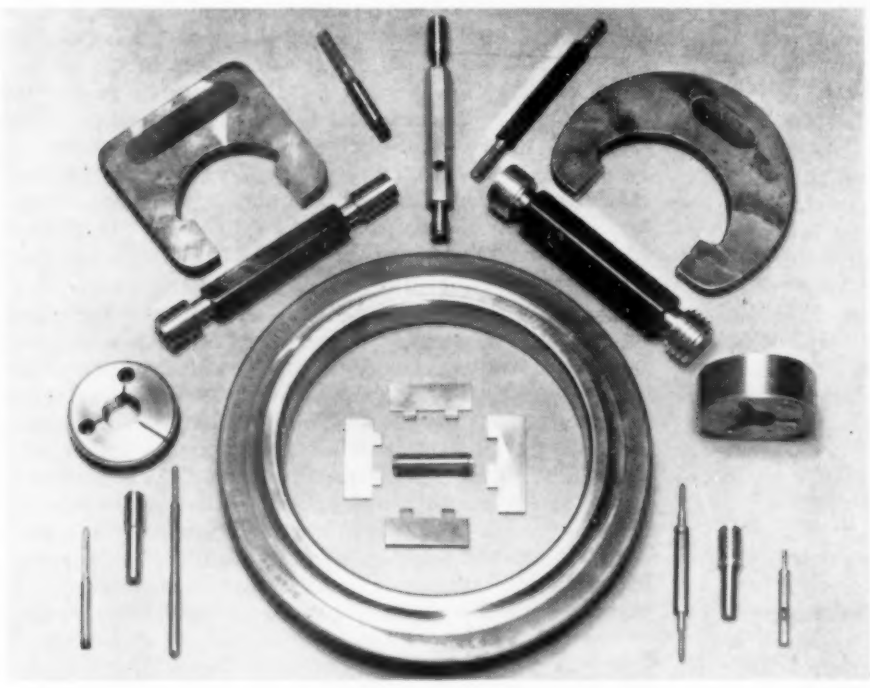
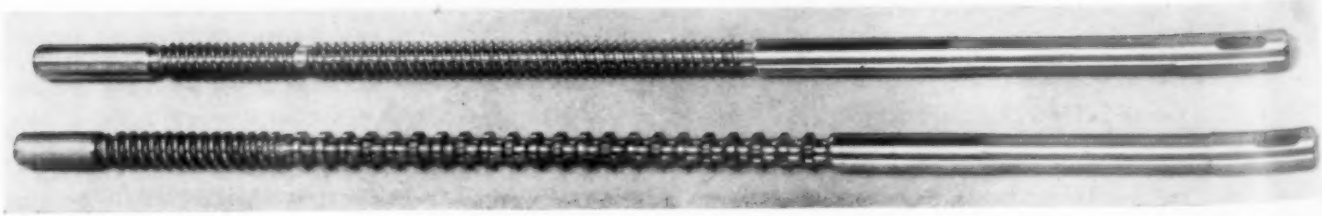


Left: A collection of chrome-plated gages and dies is shown here. Longer life, better service are obtained. Large part in center is a ring die; on either side are threading dies.

Below: Two broaches, chrome-plated for added wear resistance, are shown here in finished form.



Tailor-Made Machines From Standard Components Lead Way in Broaching Developments

By Harry H. Gotberg

CHIEF ENGINEER

COLONIAL BROACH COMPANY

THE SIGNIFICANT GROWTH in use of the broaching process in the last two years is not just due to the ability of the process to remove more metal per machine hour and man hour than any other comparable process. Much of its growth has been due to the manner in which two basic tool engineering concepts have been applied to the process as a whole. The concepts are:

1. Machines, tools, fixtures, machines and their controls and so on, are not separate things. They are interrelated parts of the complete installation.
2. Even a complete broaching setup depends for its effectiveness in solving a given manufacturing problem on how it ties in with the rest of the manufacturing processes.

To evaluate the recent progress in broaching we have to analyze how it has developed in relation to the following:

1. Original cost of
   a. Machines
   b. Tools
   c. Installation
2. Operating cost
   a. Direct labor
   b. Indirect labor
   c. Productive efficiency
   d. Operator safety
3. Maintenance cost
   a. Machines
   b. Tools

Original Cost

All of these items in turn are interrelated. Broaching machines when judged by the amount of metal removal of which they are capable per machine-hour and man-hour—have always been remarkably low in cost.

The big job has been to keep the cost down. Increased labor and materials costs have not been the only factors. For instance, we are frequently broaching, today, to tolerances only ¼th of those generally accepted as practical for broaching a few years ago. To do this we have had to make our machines more rigid; we have had to control assembly limits, improve fits and reduce wear of moving parts.

Inherent broaching machine cost therefore would be much higher today than it is were it not for interchangeability and lower-cost production—column, bases, ways, cylinder, pumps, electrical controls and hydraulic control units.

Wider application of broaching to short runs on different parts, has been made easier through more adaptable types of new machines. Some of these can do surface broaching, internal broaching or press work interchangeably—at initial cost actually less than that of a single-purpose surface broaching machine.

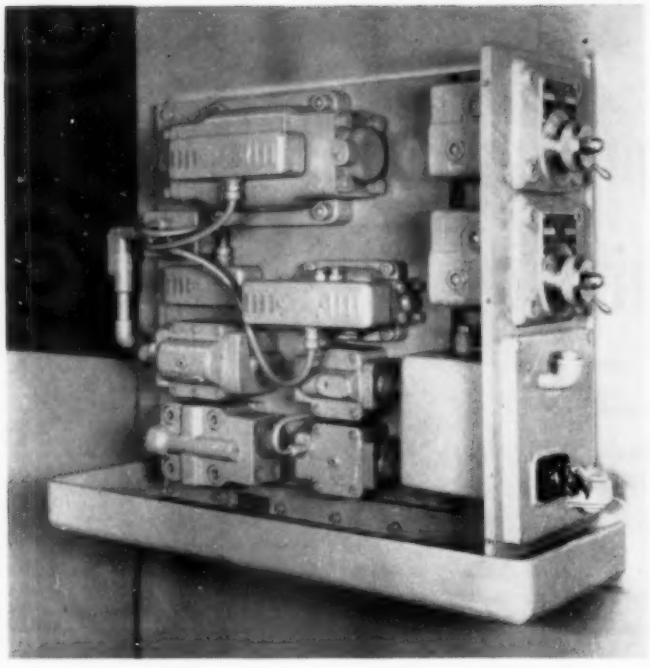
Standardization and interchangeability of machine components has also increased the convertibility of broaching equipment to other operations, thereby further reducing the cost of the equipment.

Initial cost of broaches for most installations represents a minor factor in cost-per-piece-produced, since life per grind and overall life are extremely long.

As a matter of fact a higher initial tool cost may frequently mean lower cost per piece. An example is found in the large carbide broaches used for surface broaching of large castings in high production. The cost of the broach is obviously much higher, but is more than offset by longer broach life between grinds. Much of the saving is in the reduced frequency and amount of down-time for tool changes, thus avoiding the resulting production line tie-up.

Insert-type broaches—complex broaches made up of individual, simple segments—are by nature also more costly to produce. The individual inserts, however, are easier to regrind, less costly to replace. Such broaches are practically universal today in surface broaching. In some cases, such as the carbide surface broaches, the complete broach is actually made up of individually replaceable and adjustable single-point tools, for the same reasons.

Installation cost of broaching equipment—particularly for high production work—has been reduced by a happy change in outlook. "Streamlining" not so long ago was almost a fetish among numerous machine tool users. We still design machines for eye appeal and for cleanliness, but first consideration is now given to what the machine has to do and what has to be done to it.



This hydraulic panel from a broaching machine, with cover removed, illustrates the simplicity of JIC machine designs.

On broaching machines designed for today's requirements, hydraulic and electrical controls are group-mounted on the outside of the machine, and circuits have been worked out to permit maximum ease of installation set-up, and change-over. With the increasing amount of "automation" being applied to all kinds of machines, this is of vital importance. With our newer machines and standardized controls we can modify or arrange hydraulic or electrical circuits simply and quickly to permit almost anything in the way of automatic loading and unloading, automatic clamping or indexing, automatic broach handling or even the automatic transfer from one machine to another with interlocking circuits for the two machines.

Operating Cost

Direct labor cost on broaching machines has always been low due to the high productivity of the process. Ability to "automatize" our standard machines in any direction at will has made possible further reduction in the number of man-hours required to supervise the operation of broaching equipment.

Ability to produce to closer tolerances by broaching is frequently eliminating subsequent operations, thereby further reducing total man-hours required to produce a given part. Similarly, an increasing number of plants are eliminating operations ahead of broaching by such techniques as broaching directly from hot-punched holes in forgings, thereby eliminating further machine and man-hours. Improvements in machines—greater rigidity, better broach guiding,—have facilitated this trend.

Productive efficiency of broaching machines has been greatly increased and operator effort reduced through the wider use of automatic broach handling on all kinds of broaching machines. Today we have automatic broach-handling devices for every type of broaching machine, including horizontals and even presses. Their wide adoption has been greatly stimulated through the facility with which they can be tied into machine operation with our newer circuits and controls.

Magazine loading, automatic indexing of shuttling, are all beginning to come in on broaching machines for multiple broaching of parts, using automatic machine cycling. Again operating cost is reduced by requiring less operator effort and time and increasing machine output.

Another step in this direction is the increasing popularity of broaching of parts in gangs or clusters. A typical example is in broaching the half-round and joint faces on groups of bearing caps cast in one unit and cut apart later.

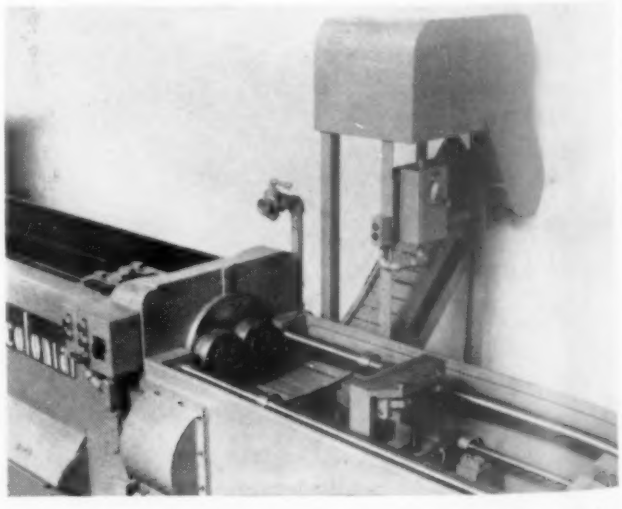
In a few cases—broaching cast iron with carbides, for instance—we have been able to raise broaching speeds to some extent, thereby further increasing machine output. In some cases, however, operating cost has been reduced by decreasing machine speed to enable the interlocking of broaching machines with machines of somewhat lower cycle time. The reduction in direct labor cost is probably much larger in the latter case than in the former. In addition, increase in tool life at lower speeds may easily mean less down-time.

Down-time is today one of the most vital factors in operating costs. We have seen cases where "streamlined" machines had to be shut down for three shifts to change a pump, and required 96 hours of indirect labor to effect that change. On our machines today, you can change a pump in approximately one hour's time.

We have found a way to greatly reduce down-time due to electrical troubles. By means of graphic check sheets and group-mounted electrical relays and limit switches, a maintenance man can visually locate almost instantaneously the source of any electrical trouble at any stage of the machine's cycle. He doesn't have to trace out circuits or study wiring diagrams.

Simple group-mounting of hydraulic controls has had a similar effect. On some designs any unit can be changed with an ordinary pipe wrench—eliminating the necessity for special tools. Pressure seals, in which the amount of sealing action increases automatically with the pressure have eliminated much of our leakage troubles. Filters can be changed without draining, shutting down the machine, or the use of special tools. Gasket-mounted valves can be removed, inspected and replaced without disturbing the piping or draining the system. Standardization of such units means the ability to carry one or two replacements in stock to fit several different places on several different machines—another potential down-time-reducer that also cuts inventory cost.

Ability to add automatic loading or transfer principles to standard broaching machines makes possible a further reduction in indirect labor—that for materials handling.



Closeup above shows ejector conveyor for automatic unloading of parts after broaching.

Cylinder block on this broaching machine is handled automatically through the machine. Block moves into machine on conveyor, is raised into cutting position by a hydraulic hoist, located by tapered plungers and ejected on far side in the same manner.

Increased operator safety has been obtained in a number of ways. Dual controls we have had with us for some time. They take the operator's hands out of the machine when the machine is to be started. Doors to electrical control panels are interlocked with the machine cycle so that they cannot be opened with the power "on". Control voltages have been reduced as a further safety measure. Automatic devices have been worked out which positively prevent a broach from accidentally dropping on an operator's hands, or on fixtures or work for that matter,—particularly valuable on vertical machines when employing large broaches.

Maintenance Cost

Probably the healthiest single influence on the design of broaching equipment was the setting up of the JIC standards for electrical and hydraulic operating units by The Joint Industry Conference of machine tool users, and machine tool and accessory manufacturers. (See Jan., 1950 issue of *The Tool Engineer*—Ed.)

Redesigning of broaching equipment to meet JIC standards in some cases has led us into cost-reducing developments which the standards themselves had not anticipated.

In the process of redesigning and relocating our operating and control units to make them more accessible, easier and quicker to service and safer, we found we could go a step further and standardize the electrical and hydraulic units for interchangeability and simplicity of circuit changes. This led us to the standardization of mechanical units as well.

Thus we not only reduced maintenance cost on broaching machines but we also increased the flexibility with which the equipment could be combined and varied in operation to meet almost any set of desired conditions, as previously indicated.

With this standardization of machine components we are now able to produce almost any kind of standard or "special" broaching installation without requiring special design and construction of basic machine components. Delivery time is cut, serviceability is increased, initial cost is lower, salvage value is increased.

Some of the factors relating to reduction of tool maintenance cost have already been mentioned—particularly those which relate to tool design. One thing more should be mentioned, however, and that is the great stride which has been taken in the improvement of broach sharpening equipment. During the past few years we have cut the time required to sharpen some types of broaches practically in half. We have designed sharpening equipment to "fit the operator"—reducing physical effort both quantitatively and qualitatively. Amount of skill required to sharpen broaches is also reduced materially through these developments.

Some Design Factors in Precision Casting

By Microcast Division
AUSTENAL LABORATORIES, INC.

PRECISION CASTING CAN be a highly successful production process for many small components, particularly those of intricate shape and design where resistance to heat, wear or corrosion is desired.

There are, however, certain limitations which should be borne in mind during the preliminary stages of design thinking on parts to be produced by the precision casting process. While many products have exceeded these limitations and have been found economical for production by this process, they represent a working guide for the engineer:

Minimum weights	2000 per lb
Maximum weight per casting	1 lb
Longest dimension per casting	8 inches
Thinnest continous section:	
Over very limited areas	0.020 in.
For extensive areas	0.040 in.
Thinnest edge:	
On an angle of 20 deg	0.015 in
On more obtuse angles this may be reduced.	

Cores Aid Design and Production

Cores reduce the weight of casting, effecting a saving in the amount of alloy, and are therefore often used even though the cored hole has no functional purpose.

Cores often permit the addition of design conveniences and features which would not be considered if the holes had to be generated by machining at added cost. They sometimes simplify casting problems by their effect on section thickness. Many parts are of such design that feeding is required at two or more locations if proper solidification is to be had. This adds to production costs. Often a design modification will permit creating or relocating holes at these locations, reducing section thickness and eliminating feeding.

Coring vs Drilling

Depending upon the machinability of the alloy involved, round holes can often be drilled more economically than they can be cored. This is especially true of small, straight holes. Higher precision of hole size and location are added advantages of drilling.

When alloys are comparatively difficult to machine, it may be advisable to core holes undersize, leaving stock for reaming or broaching. When holes are straight but have other than a round cross section, coring undersize and broaching to the finished dimension is the best procedure when close dimensions are involved.

Threaded Shapes

Special threaded parts can be cast; however, the casting procedure is not sufficiently accurate and does not produce smooth enough threads for most purposes. On parts requiring threads, the part should be cast oversize and the thread put on by the purchaser. A Class I fit is ordinarily the best obtainable by casting and in most cases requires chasing.

Design of Fixture Elements

Welding Fixtures

By Hans W. Smith

MOST OF THE PRINCIPLES explained previously for other fixtures are applicable to welding fixtures. There are, however, a few additional factors involved in welding fixtures because of the application of heat during the welding process. A welding fixture must withstand the stresses imposed by tacking or welding, in addition to the clamping stresses normally present. When parts are merely tack-welded in a fixture and then taken out for welding proper, the fixture need not be excessively heavy. Stresses set up by tack-welding are caused first by expansion through heat and then by contraction from cooling. The usual stock thicknesses for medium-sized fixture parts are $\frac{3}{4}$ in. for base with 2 in. high ribs, walls $\frac{5}{8}$ to $\frac{3}{4}$ in. thick with sufficient ribs $\frac{1}{2}$ to $\frac{5}{8}$ in. thick.

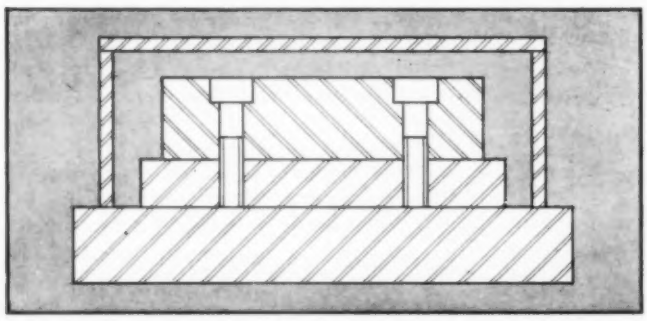
Fixtures in which the work is finish-welded are made heavier to prevent shrinking of the work in certain directions. To accomplish this the fixtures are often much larger than the part to be welded. Unavoidable distortion is counteracted by presetting the piece in the opposite direction so that welding will pull it into the desired shape.

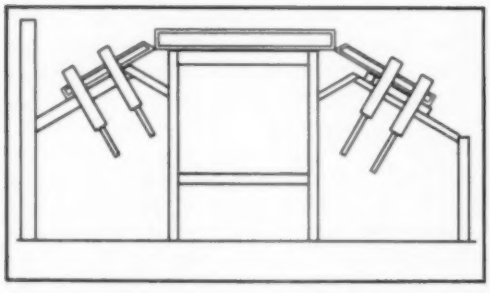
Fig. 1. The illustration shows a fixture used in the welding of three heavy plates. The fixture consists of a large angle-plate, built to be mounted on the face of a positioner. Two toggle-clamps hold the plates against their rests. The clamps for the centerplate are not shown. Note how the rests are cut away on the fixture to give access for welding and chipping.

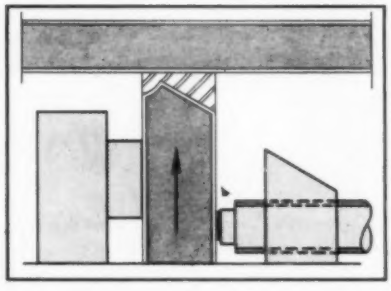
Fig. 2. Rest pads are often finished and ground. On welding fixtures it pays to protect these surfaces with a sheet-metal box cover against dust and grit, when not in use.

Fig. 3. Rests on welding fixtures require some special consideration inherent in the welding process. The rest and clamp must be so located that they will not interfere with welding. Often the work has to stay in the fixture for welding one side, and root-chipping and welding the opposite side. In this case the welded part will move when the weld cools and contracts as shown by the arrow. The clamping screw shown will permit this movement. The rest is so built that the opposite side is accessible for root-chipping and welding.

Fig. 4. Some welding fixtures are built so that the work is tacked in the fixture, then taken out and welded. In such case all stops must be so arranged that they will not lock the work in, due to the expansion of the work during tacking or the fact that some parts may come to sit slightly out of square. The heavy lines show proper location of stops for







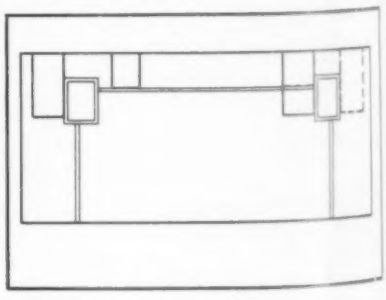


Fig. 1 (Left), Fig. 2 (Top Left), Fig. 3 (Center), Fig. 4 (Right)

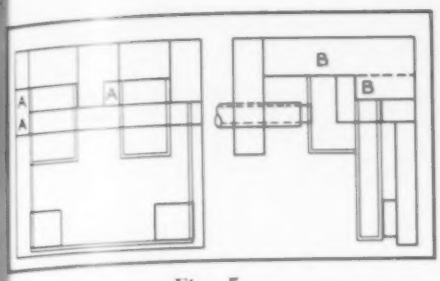


Fig. 5

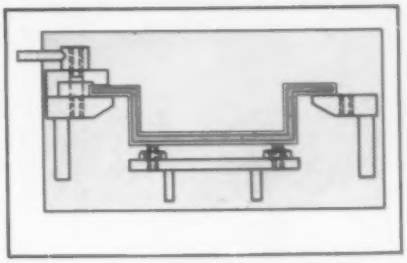


Fig. 6

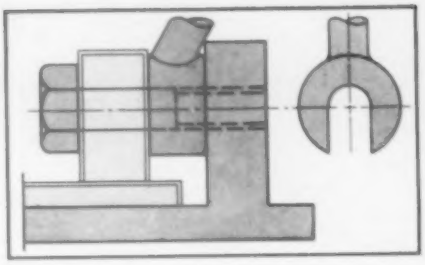
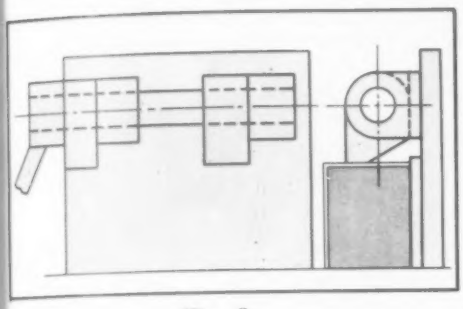


Fig. 7



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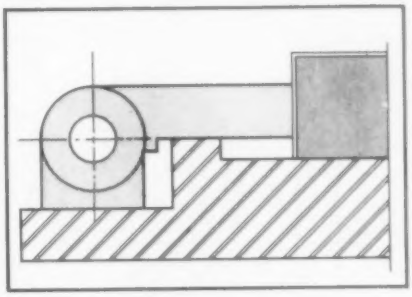

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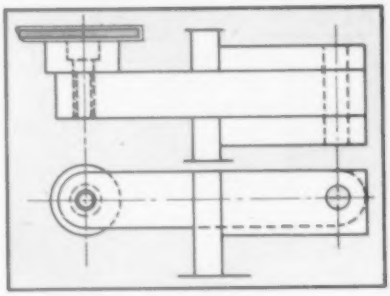


Fig. 10

the work, consisting of a plate and two blocks. The dotted lines show the stop for the block in the wrong place. Contraction which occurs after the weld cools may sometimes be in a direction to free the work again, but should not be counted upon, because in most cases the work is removed from a tacking fixture while it is still hot.

Fig. 5. This principle of placing stops on welding fixtures on one side only is here carried out in two planes. Stops *A* will permit the work to move to the right for removal, stops *B* will let it move forward toward the reader.

Fig. 6. Frequently a fixture can be made to do double duty when right and left hand parts are manufactured, by the addition of another rest and stop for the opposite hand.

Fig. 7. If the work consists of a drilled lug to be welded to a plate the lug can be held in place by a screw tightening against a loose C-washer with a short handle. After welding, the C-washer is pulled out, which takes the tension off the screw, so that the screw is easy to remove. It is not always possible to place all stops so that they will not interfere with unloading as suggested in Figs. 4 and 5. Then a stop can be used which, by turning, will give relief to the work. One way of doing this is the rotary cutoff stop.

Fig. 8. A similar solution to the problem just described is a wing stop. With this type it is possible to have a number of stops relieved by turning one handle.

Fig. 9. Another alternative is the hinge stop, which affords closer accuracy for positioning the work. As shown it requires no separate operation to move, but the work being lifted out of the fixture will turn the stop.

Fig. 10. A stop is shown here with closely machined guides for the turning part and separate screwed-on, hardened and ground pad for contact with the work. This type affords maximum accuracy and protection against wear.

Fig. 11. When a stop must be moved for loading or unloading the work, a bayonet stop can be used. It consists of a shaft sliding in a bearing and is held at a certain point by a handle moving in a hook-shaped groove. Actual contact with the work is made with a setscrew head giving the necessary adjustment. The stop illustrated is designed for use on a welding fixture. Here the shaft must be protected against grit and dust working into the bearings. This is done by dust seals at both ends of the bearing and by a protective shield around the handle.

Fig. 12. On tack welding fixtures, it is sometimes necessary to make a rest readily adjustable. The picture shows a design which permits the work to be raised until it comes to rest at the proper height, flush with the gage block.

Clamps used on welding fixtures are largely the same as described for other fixtures. However, some developed especially for welding fixtures are shown below.

Fig. 13. Screws are frequently used on welding fixtures to hold the various parts in place for tacking or welding. Since they often are near the work, the threads may become splattered and made inoperative. The design shown offers protection against splatter by cutting the thread away at the bolt and at the tapped hole. Splatter lodging on the smooth surfaces is easily removed, while that landing on the thread fuses very tight.

Fig. 14. On screws clamping work for welding extra long clearance is at times required for unloading. This design shows a pusher bar sliding in a hinged barrel which can be tilted up for unloading.

Fig. 15. A single clamp for holding small parts on tack-welding fixtures is made by this hook lever, which is dropped to an angle of seven degrees below the horizontal. The work is held against a stop by friction and the weight of the lever.

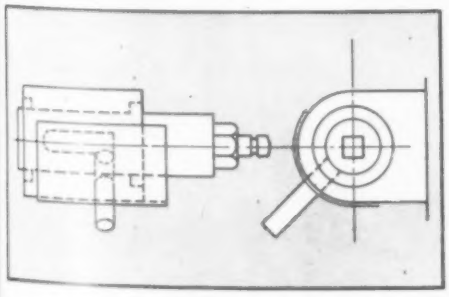


Fig. 11

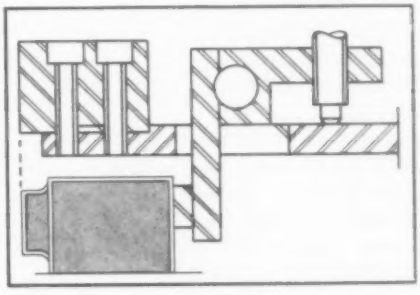


Fig. 12

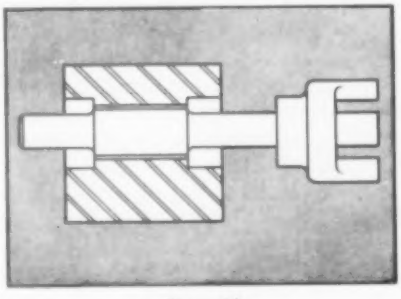
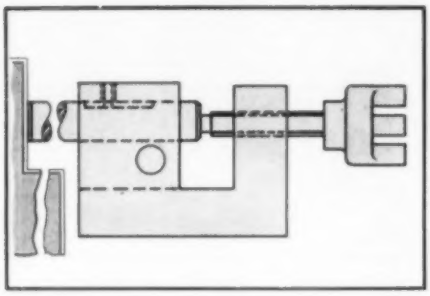


Fig. 13



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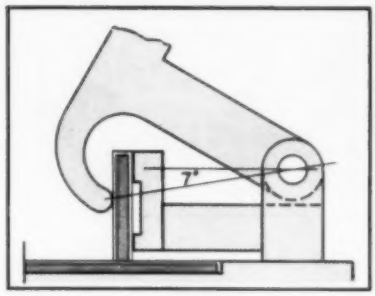


Fig. 15

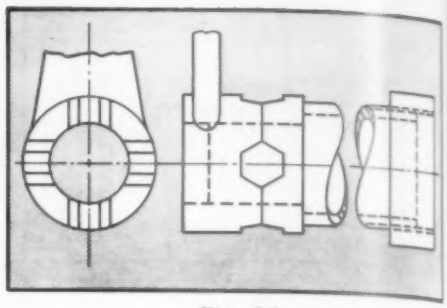
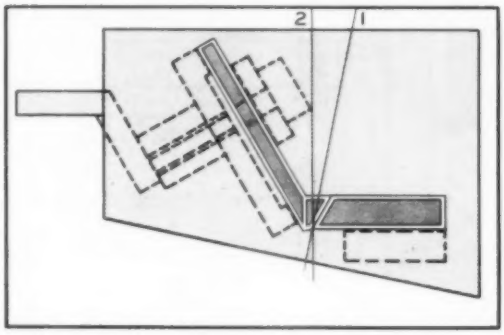
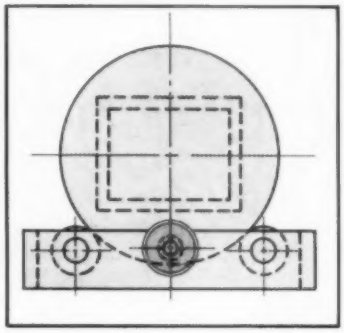
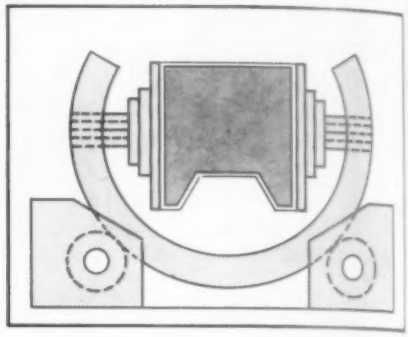


Fig. 16







(Above) Fig. 17, Fig. 18, Fig. 19
(Right, Top to Bottom) Fig. 20, Fig. 21, Fig. 22

Fig. 16. Collapsible spreader, used on welding fixtures, keeps parts of a weldment from pulling together through shrinkage. Teeth hit in working position and mesh in release position. After work has cooled the handle part is turned ninety degrees by hitting with hammer, the spacer collapses and can be removed.

TURN-OVER FIXTURES

Welding frequently necessitates turning the work while it is held in the fixture, as when both sides of a weld are to be completed before removing the work. The fixture is then built so that it permits setting up under two different angles.

Fig. 17. The most favorable angle for setting the work for the welding operation determines the angle under which the fixture faces are machined. Since the work must be fully exposed at the weld, these faces are cut on the side walls, with the rests forming the ribs between them. The fixture shown can be set up under an angle perpendicular to line one and line two.

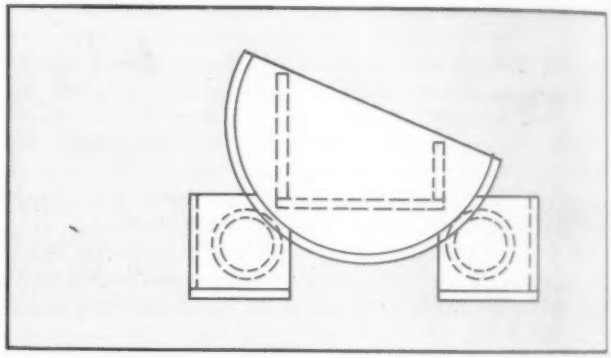
Fig. 18. A box fixture can sometimes conveniently be turned over by placing it in a cradle as shown in this illustration of a welding fixture. If the work is centered so that its center of gravity is at the center of the large disks, the work can be held at any position by the use of friction from a brakescrew and handwheel.

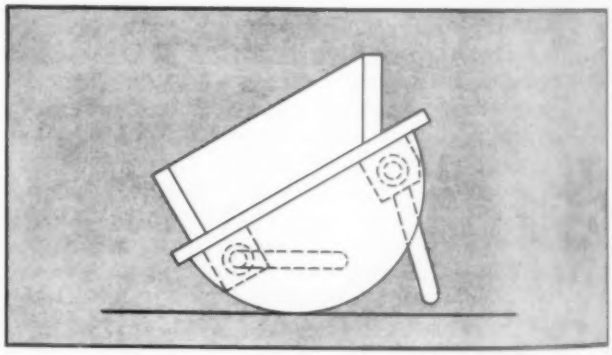
Fig. 19. The same idea as described in Fig. 18 is carried out here on a larger scale for the welding of a heavier part, which required less than three hundred sixty degrees of turning. A hoist was used to turn the work and its position kept the work in place.

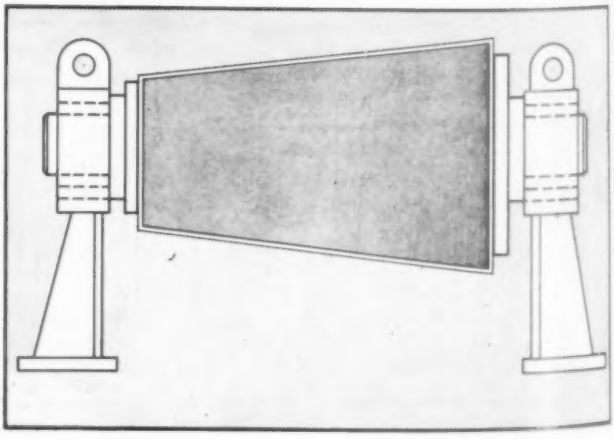
Fig. 20. Shows another cradle type of welding fixture which permits turning the work through a certain angle.

Fig. 21. Shows a welding fixture designed to roll between two definite positions on the workbench. The two pivoted legs assure steadiness in one or the other position.

Fig. 22. To turn over very large pieces of work for positioning in welding, it is often useful to build adapters which bolt or clamp to the work and contain the trunnions. Then there are only trunnion bearings required and the work can be turned around and is accessible for welding. The trunnions should be placed near the center of gravity to assure free turning of the work.







Polishing and Cleaning Metals Prior to Finishing

By Edward Engel

CONSULTING ENGINEER, COLONIAL ALLOYS COMPANY

IN A STRICT SENSE THE terms electropolishing and chemical polishing are misnomers, as they do not supplant mechanical polishing nor do they perform the same function. Electro or chemical super-buffing would probably be more descriptive.

The resultant finishes of electropolishing and chemical polishing are more like mechanical buffing than mechanical polishing. Metal is removed evenly; the action is similar to fine precision machining; thus it may supplement or complement machining operations.

Electropolishing operations present certain advantages compared to mechanical buffing and coloring, as follows:

1. Production costs are less.
2. Less machinery results in less maintenance and less stoppages.
3. Superior reflectivity on certain alloys.
4. Chains; deep, recessed areas and similar shapes are either difficult or impossible to mechanically buff, but may easily be electro-polished.
5. As opposed to mechanical buffing, electropolishing and chemical polishing perform better on the purer alloys with highly alloyed metals.
6. Such processes act to smooth threads, and machine to size.
7. Castings may be given a glitter not attained by grinding, polishing, and buffing.
8. The electropolished or chemically-polished surfaces are passivated; therefore are more corrosion-resistant than mechanically-buffed surfaces.
9. Because of the above condition, electropolished and chemically-polished surfaces are better for plating or anodizing.

The reason for factors (8) and (9) is that the surfaces are electrolytically (galvanically) passive, that is, in an equipotential state. Therefore, no preferential attack or corrosion is set up between different areas of the surface. Electropolishing and chemical polishing also remove stressed areas, and cause some non-metallic inclusions to be cleaned out. The action of either of these treatments is to preferentially dissolve away or level off the peaks. The result is a highly lustrous surface without grain distortion.

The restrictions in the present electropolishing processes include:

1. The surface of the metal to be electroplished *must* be in a similar condition as to smoothness as required for mechanical buffing.
2. The surface must be clean and excess die-metal inclusions removed or prevented from occurring. The use of highly polished or chrome-plated dies tends to prevent die-metal pick-up.
3. Certain insoluble phases in alloys, as well as deep surface imperfections such as rolling and drawing lines may be uncovered and not eliminated.
4. Electropolishing and chemical polishing processes do not have the cutting-down and burnishing action of barrel or wheel operations. Therefore, they do not present the same appearance or type of surface as the mechanical methods.
5. In electropolishing, the current densities are important, through not critical. Usually, there is a minimum current density which must be exceeded. The upper limit, however, depends more on rack contact limitations and the heat generated in the bath rather than on electrochemical phenomena. Thus, if an electropolishing operation on aluminum uses 250 A.S.F., then 40 sq ft of work requires 10,000 amp generator capacity. The amp should be 18 to 24 volts depending on width of the tank, or anode-cathode spacing. To avoid cooling difficulties and to enable the use of low voltages, about one gallon of tank capacity is required for every 5 amp. The above 40 sq ft operations, therefore, would necessitate a 2,000 gallon tank.
6. Rack costs are two to three times that for plating because of the heavier current densities.
7. Tanks must be of heavier construction than for plating or anodizing due to the higher specific gravity of the electropolishing electrolytes.
8. Tank linings may include: chemical lead, brick, Saran, Koroseal, Polythene; dependent on the electrolyte.
9. The cost of equipment may be considerable. A 40 sq ft work-capacity surface area unit may approximate an expenditure of $50,000 or more.
10. Each operation must be "cut-to-pattern," dependent on shape, dimensions and alloy to be treated.
11. Anode (work) and cathode spacing is dependent on voltage. Usually 4 to 8 in. spacing is most efficient; therefore, conforming cathodes are required for some shapes.

12. Some electrolytes are relatively short-lived; others, like the citric-sulphuric acid electrolyte have a very long life, except for drag-out.

13. Surfaces with 50-60 microinch finishes may be electropolished or chemical polished to 40-50; and, 5-7 microinch finishes may be reduced to 3-4.

14. The electrolytes, being viscous, have high drag-out losses.

15. Electropolishing operating usually requires 2-20 minutes.

16. Racks are copper with bronze clips or stainless steel, according to the metal to be processed.

17. Usual operations remove 0.001 in. of metal in 10 to 12 minutes, or about 0.0001 ipm.

18. Orange peel and sand-cast surfaces of stainless steel cannot be electropolished in a reasonable time.

19. Aluminum with uneven surfaces, as a result of poor mechanical preparation or metal inclusions from drawing dies, does not respond well.

20. Aluminum alloys containing silicon cannot be electropolished or chemically polished, and the copper-content alloys do not respond as well as the more pure alloys.

There are well over a hundred commercial installations of electropolishing units. The applications, for the most part, are on ordinary 18-8 stainless steel and the high-purity and 28 aluminums. The commercial units are used not only for buffing, but also for electrolytic machining to size,

Some of the electropolishing processes operate on two or more metals; in some instances, slight chemical additions or operative changes are required in order to polish a different alloy or metal.

Wrought aluminum alloys are usually polished in electrolytes consisting of phosphoric acid and various percentages of sulphuric acid, with or without chromic acid. Fluorides, hydrofluoric acid and also certain alkali solutions are used in electrolytic polishing of aluminum. Current density is 100 to 250 A.S.F., 18 to 24 v at about 160 deg F.

Brass: Brasses, other than lead brass, (free cutting brass) respond to electropolishing in a solution consisting of 63 percent phosphoric acid, 15 percent sulphuric acid and 22 percent water. Copper may also be readily polished in the above type of bath. Current density is 200 to 500 A.S.F. at 4 to 10 v.

Monel: Monel and nickel-silver can be processed in the same type of bath as brass, though a higher current density is required.

Silver: Silverplate is polished in the conventional silver cyanide plating bath by pursuing the following procedure: Instead of applying the current continuously to the part to be plated, it is alternately reversed, by means of a relay, at intervals of a few seconds. The number of intervals or interrupted sequences that are necessary is indicated by the appearance of the work. The current density is about four times that in conventional plating. The foregoing silver plating-electropolishing sequence is a development of the Westinghouse Electric Corp. The process is said to produce a mirror finish at a great saving in metal.

Stainless Steel: Stainless steel electrolytes may be similar to the sulphuric-phosphoric-chromic acid solutions used for aluminum, or the bath may be a citric-sulphuric acid solution.

Zinc: Commercial and alloy zincs do not respond to electrolytic polishing. Pure zinc does, but its processing serves no practical purpose.

Chemical polishing is a development of Colonial Alloys Co. Among the advantages claimed are lower equipment and installation costs, and lower operating costs. The latter is made possible by the fact that small work or work which is not to be subsequently anodized, may be processed in baskets; individual racking is not required. In addition, work to be anodized may be chemical-polished on anodizing racks, whereas electrolytic polishing requires heavy stainless-steel racks, followed by reracking for anodizing. A shorter time cycle is possible; about a minute is a maximum and one-half a minute is usual.

Bright Dips: Copper and its alloys may be brightened in a bath consisting of 1.75 ounces of sulphuric acid, 1.33 ounces of nitric acid, 1.1 ounces of hydrochloric acid per gallon of water. The operating temperatures range from 95 to 140 deg F, depending on the alloy. A somewhat similar bath includes the use of chromic acid to prevent nitric acid loss, although staining may result.

Cadium and zinc may be brightened in a 4 to 7 percent solution of 30 percent strength hydrogen peroxide with one-fourth to one-third of one percent of sulphuric acid. Magnesium also responds to a similar bath. The pH is maintained at 2.68. The process is patented. The "Zinctone" brightening dip of Turco Products Company is also said to present a lustrous silver-like finish on zinc.

METAL CLEANING AND PASSIVATION

There are two types of forces which hold materials together, cohesive and adhesive forces. Cohesion is the attraction between like materials. The physical state and mechanical properties of a material depend upon the type and magnitude of its cohesive bonds.

Adhesion is the attraction between unlike materials. Oils, dirt and solid particles are held to metal surfaces by adhesive forces. Metal deposits and lacquer films are also bonded to metal surfaces by adhesive forces. Therefore, metal cleaning concerns itself with adhesive forces.

The type of adhesive bond which holds oils and certain other liquids as well as some solids to metal surfaces, are known as Van der Waals forces; and, to a lesser degree, electrostatic bonds may be involved.

A solid, such as buffing compounds, and liquids such as certain oils used for drawing and machining metals will wet a metal surface to a degree dependent upon the magnitude of the attractive or adhesive forces between the substance and the metal surface and the cohesive forces within each. It is certain the adhesive bond formed is not primarily a mechanical phenomenon. The interfacial bond between certain substances and metal surfaces is thought to be of a chemical type. This type of reaction is often evidenced by a definite etch, if the adhesive bond is strong or if it is permitted to remain in contact with the metal surface too long. Consequently, it is of the utmost importance to obtain immediate removal of drawing oils and buffing compounds.

In cleaning metals, it would be a favorable condition if all oils, grease and dirts were easily removed. But this ideal cannot always be achieved. For in shaping metal, the reverse condition is required, that is, to prevent metal-to-metal contact between the tools and the work. Otherwise, rough surfaces or failure will occur. And, in order to hold an oil film on the metal and drawing tools under the conditions of high pressure and high temperatures at localized areas, it is necessary to secure strong adhesive forces or adsorption of the film by the metal surface.

Prior to applying drawing oils, annealing or normalizing or other metal surface treatments, the surfaces must be cleaned and in an otherwise proper condition. A clean surface is paramount if strong tenacious adhesion is to be obtained in chemical and electrolytic surface treatments. And, cleaning prior to annealing and normalizing is required to prevent carbonizing the oil which would subsequently be impressed into the work in an inter-stage drawing operation.

Removal of buffing compounds as quickly as possible is of prime importance to prevent any adsorbed film from reacting with the metal to form insoluble metallic soaps. Also, plating or any other subsequent treatment should be done im-

mediately after the removal of the buffing compound. The greater chemical activity of the Beilby layer, created by the buffing action, increases the likelihood of the surface becoming contaminated or oxidized by atmospheric corrosion.

Knowing the nature of the substance or substances to be removed the general rules are usually successful.

1. Mineral oils may be dissolved in:

(a) Mineral-oil solvents or spirits with a flash-point over 100 deg F, referred to as "safety-solvents." They are operated at room temperature, venting is seldom required, but automatic fire-prevention equipment should be installed. Solvents should be agitated, mechanically or with air.

The "safety-solvents" vary in their solvency-speed (the relative speed required to remove a given oil), and solvency-power (the comparative amount of oil a solvent is capable of dissolving before it becomes too loaded for practical purposes). Therefore, the initial cost is not the sole criterion of value.

(b) Emulsifiable solvents are also efficient degreasers, and are especially economical for the removal of heavy oils, greases, and oils combined with solid particle dirt. As opposed to mineral spirits, the efficacy of an emulsifiable solvent is not judged from its solvency-speed or solvency-power but by the rapidity with which it converts the oil to an emulsifiable state, with minimum solvency in order not to load the "solvent" itself. The purpose is to change the oil or grease, while still on the surface of the metal, into a state which will readily become an emulsion when subsequently treated in water or steam.

The emulsion should be agitated, and subsequent water treatments should include a force-spray or steam-jet.

(c) Vapor-phase degreasing machines, utilizing trichlorethylene or similar stabilized non-flash-point solvents, are very efficient for small parts in quantity production. The effectiveness of this method is such that in some operations no subsequent alkaline cleaning solutions are used prior to anodizing and other processes.

2. Animal or vegetable oils are saponified in various alkaline solutions depending on the metal. All such solutions are operated at elevated temperatures and preferably mechanically agitated. Subsequent water rinses should be agitated, and preceded by a force-spray rinse. The latter precautions are as necessary as the proper cleaning solution.

3. Some combinations of mineral oil and animal or vegetable oil, may be saponified by proper alkaline solutions.

Prior to plating or similar treatments following the removal of mineral oil by solvency or emulsification, it is necessary to enter an alkaline solution.

Caustic soda solutions are efficient cleaners, but they are difficult to rinse and tend to etch zinc and are too harsh for use prior to decorative anodizing of aluminum.

The pH of the usual caustic soda solutions is as follows:

0.0004 gms. per liter (0.0001 Normal Sol.) = 9 pH
0.004 gms. per liter (0.001 Normal Sol.) = 10 pH
40.8 gms. per liter (0.12 Normal Sol.) = 13 pH
½ percent by weight of NaOH = 13.6 pH
2 percent by weight of NaOH = 14 pH

Sodium carbonate may be added to caustic soda solutions to increase the saponifying power. And, certain inhibiting agents such as sodium silicate or sodium dichromate or phosphates may be added for cleaning aluminum.

Whether caustic soda is used alone or in combination with other alkali salts, or weaker alkalies are used without caustic soda, it is usual to use an appropriate wetting agent, and if soft water is not procurable a chemical sequestrant should be used. Some of the sequestrants are sodium-hexametaphosphate, tetra-sodium pyrophosphate or sodium-tetraphosphate.

The above sequestrants should not be used with solutions for cleaning aluminum prior to anodizing. Inhibited cleaners also tend to destroy the efficiency of anodizing solutions. See Table I for data on alkali salts or pickling solutions.

Preparation of aluminum for lacquering: Anodized aluminum surfaces provide excellent bonding properties as well as superior corrosion resistance and good abrasion resistance. The anodized aluminum has a minimum of 250 hours salt spray resistance (approximately three times that of chrome plate). Anodic treatments of aluminum are the only processes which produce results which meet the requirements of Army and Navy Spec. AN-QQ-A-696a.

When anodizing is too expensive or the exposure is not too severe, one of the following procedures may be used. Alcoa's "Alrok Process," American Chemical Paint Company's "Alidene," Colonial Alloys Company's "Chemoxiding" and Parker Rustproofing Company's treatments as well as others which meet AN-C-170 specifications.

The above-named processes create excellent surfaces for paint and lacquer adherence and fair corrosion resistance. But these processes are not applicable for clear lacquer bases when the natural metallic appearance is to be maintained, as these treatments present a gray or olive drab appearance.

Clear lacquering on aluminum requires a passivated surface which presents the natural lustre of the metal. Anodizing after chemical-polishing or a chemical-immersion process will comply with the requirement.

As has been indicated, aluminum which has merely been cleaned is not suitable for paint or lacquer application. It will not pass any of the conventional tests. It seems rather penurious to clean aluminum and neglect to insure lacquer adherence, just to save an added cost of around two cents per sq ft. If price is that much of a consideration; instead of clear lacquering on an unprepared surface, anodizing alone may present an equal surface appearance and stability at less cost than clear lacquer.

Special cleaning applications: Aluminum alloys containing silicon, such as the popular types of die castings, some sand castings, 32-S and 61-S require a smut-removing dip following the cleaning operation. Hydrofluoric-nitric acid solutions in 1:1 to 1:7 ratios remove the silica smut.

One part of HF and four parts of HNO_3 to 95 parts of water removes stains from heat-treated aluminum and corrosion products from all aluminum alloys prior to cleaning or buffing. A mixture of 1:1 HF-HNO_3 with 56 parts H_2O removes graphite from aluminum forgings.

In all HF solutions, the operations are in either lead-lined, carbon-brick lined, waxed or pitched vessels at room temperature for but a few seconds.

Though aluminum etching operations are not performed for cleaning purposes, they do act to clean:

1. A 2 to 5 minute dip in a 2 to 5 percent caustic soda solution at 125-135 deg F preferably containing a suitable wetting agent and salt, rinsed and immersed in a 20-30 percent nitric acid solution at room temperature will give a fairly fine etch on wrought aluminum alloys.

2. A similar caustic treatment to the above, followed by a water rinse and a dip in a solution of 8 parts nitric and 1 part hydrofluoric acids at room temperature; then following the foregoing with: (1) electropolishing, (2) rinsing, (3) 50 percent nitric acid dip, (4) thorough rinsing and (5) anodizing will produce a silvery finish on silicon alloys.

3. Certain proprietary solutions produce a finer etch than caustic solutions.

4. About 30 percent nitric and 2 percent sulphuric acids with ½ ounce of sodium chloride per gallon of solution, operated at 210-212 deg F for 15 minutes gives an etched or frosted surface on wrought alloys. In the above processes the etched surfaces are easily soiled and show finger prints. Anodizing (or anonizing) stabilizes the finish and prevents soiling.

5. Design etches: Print design on the surface. Dust ink on the design with 200 mesh asphaltum powder, blow off any surplus. The powder is then fused by heating to above 400 deg F. The surface of the article with the protected design is then activated in a 10 percent solution of hydrofluoric acid, and rinsed. The unprotected surface area is etched by the action of an iron chloride and hydrochloric acid solution. A HNO_3-HF acid solution saturated with table-salt used as a dip, prior to the treatment in the acid etch presents a smoother and less streaky surface.

Brass may be solvent degreased or mineral oils may be removed by emulsification. Animal or vegetable oils and particles of dirt are saponified by appropriate alkaline solutions. The pH of the latter is higher than those used for aluminum or zinc. Anodic and cathodic cleaning is performed in about the same types of solutions as still-tank cleaning.

Lacquering brass, copper, and gold and silver plate. When the foregoing metals are handled or exposed to even mild conditions they lose their pleasing appearances in a matter of days. To protect against too early of a loss in appearance, two coats of the best baking lacquer should be applied. Air dried lacquer has doubtful value.

In order to present even a fair stability, a deposit of 0.00001 in. is the minimum, and this deposit should be on nickel plate followed with gold plate which should then be lacquer-coated with one or two baked coats.

Copper alloy cleaning: The cleaning of copper and its alloys (brass and bronze) preparatory to lacquering presents no difficulties. Their cleaning prior to plating may be in still baths at elevated temperatures or in electrolytic baths. Cathodic cleaning is usually practiced, although anodic cleaning is operated with a ferric sulphate bath. Since copper alloys are susceptible to "water-breaks" when cathodically cleaned, a momentary anodic treatment may be used to remove film.

Magnesium alloys respond to similar strong alkali cleaning solutions as steel. Cathodic cleaning may be operated in certain solutions; one contains 7.4 percent sodium silicate, 0.9 percent sodium lauryl sulphate at 150-195 deg F temperature with a current density of 50 A.S.F., for about one minute. Ten percent solutions of chromic acid at elevated temperatures are an effective cleaner.

Monel and nickel may be cleaned in a solution containing ½ to 1 pound of sodium cyanide. Cathodic cleaning of buffed nickel plate may be performed in a strong sulphuric or hydrochloric acid solution; followed by a rinse in diluted acid and then water rinsed.

Stainless steel may be descaled, as well as steel or iron, in a fused caustic soda bath or in fused sodium (DuPont process). Cleaning is also effected in the fused baths. In addition, cleaning may be done in the alkaline solutions used for steel. Electrolytic cleaning, particularly used after buffing, for 2 to 3 seconds with reverse current at about 200 A.S.F. is in an alkaline solution.

Scale may also be removed in a solution containing 4 ounces per gallon of Ferrisul and 2 ounces per gallon of HF at 160 deg F. If the scale does not respond quickly to the "Ferrisul" solution, then a two-step operation is necessary. The first step loosens the scale; this bath contains 12 ounces per gallon of sulphuric acid at 180 deg F. The second step consists of a bath containing 2 ounces per gallon HF at 160 deg F. The metal must be passivated in a HNO_3 solution after any pickling bath.

The passivation solution is a 1:1 nitric acid water solution operated at room temperature; the immersion time is 1 to 4 hours. A more dilute HNO_3 solution (10-20 percent) operated at elevated temperatures accomplishes the same result in a few minutes.

The test for ascertaining the passivation or iron removal consists of a dip in a solution containing 1 ounce H_2SO_4, 4 ounces of $CuSO_4$ to a gallon of water. If the stainless steel

TABLE I—PROPERTIES OF SOME COMMON TREATING SOLUTIONS

ALKALI	Active Na_2O	Total Na_2O	pH Value 1 percent Solution at 20°C	pH Value 10 percent Solution at 20°C	Amp per Sq Ft Comparative Electrical Conductivity at 6v;4 oz per gal. of salts		Concentration 0.32 Oz. per gal. Grams, Weight Loss per Hour	
					20°C	100°C	Tin 180° F	Aluminum 212° F
Caustic soda	75.5	76.0	13.5	14.7	26.30	64.90	....	13.5 pH 129.00
50 percent caustic and 50 percent metasilicate (granular)	51.5	52.6	...	...	16.20	41.10	....	....
Sodium sequisilicate	36.5	37.9	12.7	13.5	10.10	27.30	....	....
Sodium metasilicate	28.0	29.2	12.5	13.3	6.58	20.40	12.0 pH 0.14	12.6 pH 0.22
Silicate of soda	18.7	19.7	12.0	13.4	3.3	11.40	....	....
Trisodium phosphate	10.0	18.0	12.0	12.9	3.76	15.65	11.6 pH 0.92	12.0 pH 21.9
Sodium carbonate	29.0	58.0	11.4	11.6	7.05	23.20	11.2 pH 0.79	11.4 pH 31.60
Tetrasodium pyrophosphate	8.1	23.3	10.1	10.3	3.86	12.50	....	....
Borax	8.4	16.3	9.2	9.3	2.12	7.55	....	....
(Modified soda) carbonate of soda; sodium acid carbonate	...	...	9.9	9.5	...	...	10.0 pH 0.47	....

PICKLING: *The addition of one of the various proprietary organic inhibitors and in some cases wetting agents (as well as agitation) restricts (1) hydrogen embrittlement, (2) excessive attack on metal, and (3) saves acids, and (4) prevents fumes to a great extent. Hydrochloric acid pickles do not cause hydrogen embrittlement to the extent that sulphuric acid pickles.

Newer developments in pickling are the treatment of steel in chlorine vapors for the removal of light scale, and the treatment of cast iron for the removal of silica and scale in a molten bath of Kolene, a proprietary compound at temperature and at a current density of 8 to 25 amp per sq ft cathodically.

Oxidation occurs on metals following pickling and alkaline cleaning rinses upon drying, especially when hot water rinses are used. Proprietary water-soluble compounds may be used in the rinses, which will inhibit oxidation. The inhibited surface may be painted upon, or may be removed by a water rinse when the metal is to be plated.

does not accept a copper deposit, passivation has been accomplished.

Preparing steel for lacquering: In the production lacquering of steel it is necessary to have a physically clean surface. Castings, if not too heavily oiled, may be sand-blasted prior to lacquering. The sand removes corrosion products and solid particle dirt and scale.

Machined, drawn and stamped parts, however, may be cleaned by procedures similar to the following alternates.

1. Solvent degreasing, by:
   (a) immersion in a "safety-solvent,"
   (b) vapor phase degreasing in trichlorethylene,
   (c) spray treatment or immersion in solvent emulsions,
   (d) immersion in a liquid which acts to make the oil or grease emulsifiable. A subsequent dip in water, hot or cold, water-spray or steam-jet treatment completes the emulsification and the removal of the oils.

Following any of the above treatments, the physically clean metal is thoroughly dried, then lacquered. In some instances, the residue left by the solvent is not compatible with the lacquer thinner. Under the latter condition, the metal may be cleaned by one of the procedures as follows:

1. Solvent degreasing by one of the methods noted above and an immersion in an alkaline solution, or
2. A single immersion in an alkaline solution.

Following the alkaline dip, the work is rinsed, but if permitted to dry it will rust within a few minutes. Therefore, further surface preparation is necessary if maximum lacquer adherence is desired. Phosphatizing or "Zincilating" treatments following the cleaning cycle produce a passivated, rust-free surface. The created surface is somewhat porous and corrosion resistant. The above surface properties provide improved lacquer adherence and increased corrosion resistance. Several proprietary phosphatizing solutions are offered. A satisfactory inhibitive wash, originated by the U.S. Engineer Office, has the following composition: (Also see U.S. Army Specification No. 98-20,007).

	Weight Percents
Orthophosphoric acid (commercially pure H_3PO_4)	7.00
Sodium dichromate	.075
Carmel solution	0.50
Wetting Agent such as "Cellosolve"	0.50
Water	91.25

Preparing steel for plating: Cleaning steel preparatory to plating requires similar procedures as for lacquering. The resultant surface, however, must be chemically and metallurgically clean. A better-balanced alkaline solution is required for plating than for lacquering preparation. The alkaline cleaners may contain one or more of the sodium alkaline salts in varying proportions, in addition to which a suitable wetting agent and one or more detergents may be added. In some cases a material like sodium hexameta-phosphate, tetra-sodium pyrophosphate or sodium tetraphosphate serves to soften the water. Such solutions are operated at elevated temperatures and preferably agitated. This type of bath may be adapted for anodic cleaning. In the latter operation the steel to be cleaned is made the anode and the tank or a separate metal is the cathode. The operation is usually at temperatures from 145 to 210 deg F and current densities of 10 A.S.F. to 100 A.S.F.

Prior to plating, the cleaned metal is given a few seconds dip in a 3 percent sulphuric acid solution at room temperature. Water-breaks generally result from films of mineral oil or soap of fatty acids, which are apt to be indicated following an acid dip. More thorough rinsing or alternate hot and cold rinses may remedy the above condition. "Soaps" are permitted in electrolytes for cleaning steel, but not in the electrolytic cleaning solutions for brass and zinc. If a water-break occurs after the acid dip, which follows cleaning in a soap solution, the remedy may be the use of a detergent. The latter must be compatible in acid and alkaline as well as neutral solutions: "Orvus W. A. flakes" and "Hart detergent" are examples of such detergents.

Zinc die castings may be cleaned in mild alkaline cleaners, the pH of which may be slightly higher than permissible with aluminum. Cathodic cleaning is effective in an 8 ounce per gallon solution of sodium carbonate or in a bath containing 1-2 ounces per gallon of caustic soda at a temperature of 180 deg F; the current density is 40-50 A.S.F.

Preparation of zinc for lacquer applications requires solvent or alkaline cleaning and a subsequent treatment in one of the proprietary solutions similar to "Anozinc" or "Iridite," or "Paint Bond."

In all instances the water used for alkaline cleaning baths should be soft. The simplest approach is to treat ordinary tap water, prior to dissolving the cleaning salts, with one of the chemical sequestrants previously listed.

The addition of a suitable wetting agent will also improve cleaning operations. A non-ionic wetting agent may be used in either type of electrolytic cleaners, or the latter may be used in addition to the ionic type designated.

It has been found that the use of two wetting agents or detergents is more effective than a single one.

The basis for all alkaline cleaning action is the saponification of animal and vegetable oils. Alkaline cleaners are not effective in removing mineral oils.

Testing Cleaning Solutions

There are several laboratory testing methods for ascertaining the effectiveness of cleaning solutions. An easily-operated procedure, however, and one which requires no expensive equipment, is as follows:

1. Prepare the cleaning solution to be tested in the same manner as in commercial practice.
2. Operate at the same temperatures as in practice.
3. Clean small glass panels by wiping thoroughly with alcohol or other volatile solvents.
4. Immerse the glass panels in the test solution for 2 to 5 minutes.
5. Remove and drain panels for a minute.
6. Allow panels to dry naturally.
7. Observe for any film or haze.
   (A haze indicates the presence of a film which may interfere with plating, anodizing or painting.)
8. Immerse metal test pieces or the actual work in the cleaner, the surfaces of which are to have the same soil and oil which are to be removed in commercial operation.
9. After varying time intervals of 2-20 minutes remove specimens; drain for 1 minute.
10. Cold water rinse.
11. Immerse in a 3 percent H_2SO_4 bath at room temperature.
12. Thoroughly rinse.
13. Steel specimens are then dipped in the same type of H_2SO_4 $CuSO_4$ bath as used for testing the passivation of stainless steel.

A uniform copper deposit indicates the steel is in a suitable condition for plating.

While water-free methanol or isopropyl alcohols remove the inorganic salt residues left from finger prints, their use is prohibited due to their high flammability. Therefore, care must be exerted not to handle work after it has been cleaned.

The American Society for Testing Materials—Committee D-12—has developed methods for cleaner analysis and testing. See their publication. "Standard Methods for Cleaning Compound analysis." Committee D-12, Section-G offers a bulletin "Metal Cleaning Problems for Furnishing Methods and Specifications for Industry."

Resharpening Reamers

HOW TO REDUCE REAMER SIZE

To reduce the diameter of a carbide reamer by .0002 or .0003, it is necessary to use a lap, since it is not practical to remove such a small amount with a standard tool and cutter grinder.

Carbide tipped reamers may be lapped as follows:

1. Drill and ream a hole in a piece of cast iron or mild steel slightly thicker than the length of the carbide insert.
2. Mix some 180 or 240 grit diamond dust with a fine light weight oil to paste solution. By means of a toothpick or a match apply this solution to the cylindrical land of the carbide inserts only. This solution should be spread just thickly enough to cover the land of the carbide. Insert the reamer in the hole of the cast iron block and revolve anti-clockwise (providing, of course, that it is a right hand cutting tool) for ten to twelve complete revolutions.
3. Remove the reamer from the hole. Wipe off two opposite flutes and check for size. Repeat this operation, adding diamond dust paste only when necessary until the reamer has been lapped to the specified dimension.
4. Do not try to remove more than .0003 or .0004 from reamer diameter unless the reamer diameter exceeds 1". Then you can safely remove .0006 to .0008.

HOW TO ELIMINATE CHATTER

Chatter is most detrimental to carbide tipped reamers and should be eliminated immediately by . . .

1. Increasing the feed per revolution.
2. Reducing the number of revolutions per minute.
3. By use of close fitting bushing .0002 to .0003 larger than reamer diameter.
4. By grinding the secondary lead angle of approximately 2° on carbide immediately back of the 45° chamfer.
5. By use of power feed instead of hand feed. POWER FEEDS SHOULD BE USED WHENEVER POSSIBLE.

COOLANTS AND LUBRICANTS

Any standard type coolant or lubricant can be used. A heavy flow of soluble oil and water gives satisfactory results in most cases. Use heavy flow to prevent intermittent quenching of carbide tip. Light cutting oils are recommended for superior finish, but do not have the heat dissipating qualities of soluble oil. Avoid strong solutions of sulphur base oil as much as possible.

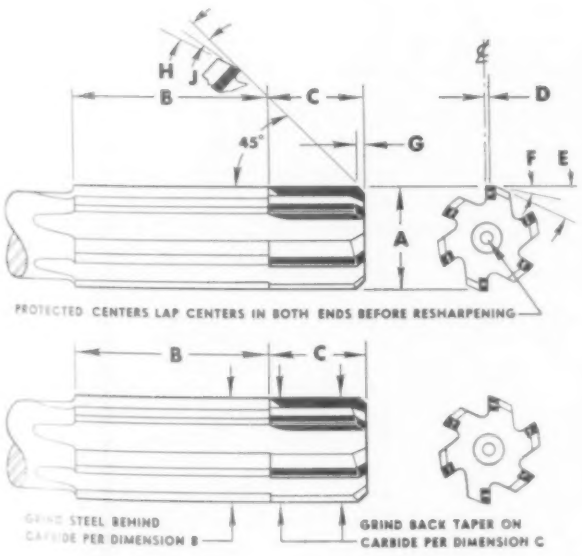
SUGGESTED FEEDS AND SPEEDS AND STOCK REMOVAL

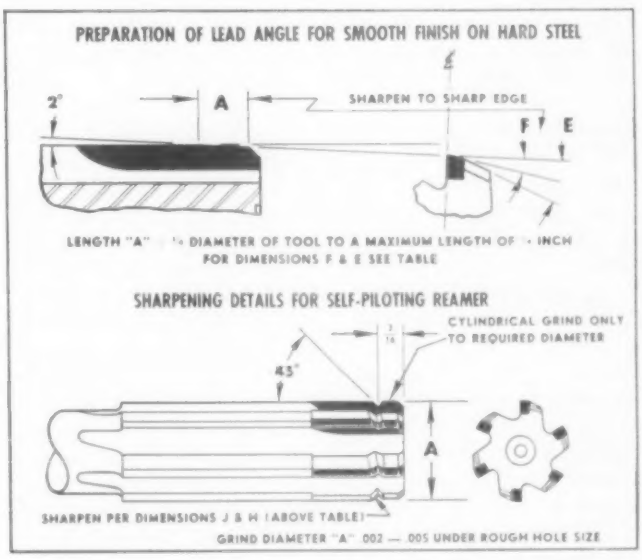
MATERIAL	Speed Ft. Per Min.	Feed In. Per Rev.	STOCK REMOVAL	
			Reamer Size (Diam.)	Stock Removed from Hole Diam.
Steel—All types 400 Brinell or more	35—45	.002—.004	.125— .2344	.003—.005
			.25 — .4844	.005—.008
			.500— .7344	.008—.012
			.75 — .9843	.012—.015
			1.0 —1.500	.015—.020
Steel—All types 250—400 Brinell	45—65	.004—.006	.125— .2344	.004—.006
			.25 — .4844	.006—.010
			.500— .7344	.010—.015
			.75 — .9843	.015—.020
			1.0 —1.500	.020—.025
Steel—All types 250 Brinell or less	65—90	.005—.010	.125— .2344	.005—.010
			.25 — .4844	.010—.015
			.500— .7344	.015—.025
			.75 — .9843	.025—.030
			1.0 —1.500	.030—.045
Malleable and Cast Iron	60—80	.006—.012	.125— .2344	.005—.010
			.25 — .4844	.010—.020
			.500— .7344	.020—.030
			.75 — .9843	.030—.040
			1.0 —1.500	.040—.050
Non-Ferrous and Non-Metallic	100—175	.005—.015	.125— .2344	.005—.010
			.25 — .4844	.010—.015
			.500— .7344	.015—.025
			.75 — .9843	.025—.035
			1.0 —1.500	.035—.045

NOTE—When using ¼" diameter reamers or less, it is advisable to reduce surface feet per minute shown on table by approximately 25%—when using ¾" diameter reamer or larger, increase surface feet per minute approximately 25%.

A	B		C		D	E	F	G	H	J
Reamer Diameter	Back Taper	Length	Back Taper	Length	Circular Land	Angle On Steel	Angle On Carbide	Length Of Chamfer	Angle On Steel	Angle On Carbide
.250	.0005	1	.0002	1/2	.005	27 deg.	7 deg.	1/32	27 deg.	11 deg.
.2812	.0005	1	.0002	1/2	.005	27 deg.	7 deg.	1/32	23 deg.	11 deg.
.3125	.0005	1	.0002	1/2	.005	27 deg.	7 deg.	1/32	23 deg.	11 deg.
.3437	.0005	13/16	.0002	11/16	.005	27 deg.	7 deg.	1/32	23 deg.	11 deg.
.3750	.0005	13/16	.0002	11/16	.005	27 deg.	7 deg.	1/32	23 deg.	11 deg.
.4062	.0005	1 1/16	.0002	11/16	.010	25 deg.	7 deg.	1/32	23 deg.	11 deg.
.4375	.0005	1 1/16	.0002	11/16	.010	25 deg.	7 deg.	1/32	23 deg.	11 deg.
.4687	.0005	1 1/16	.0002	11/16	.010	25 deg.	7 deg.	1/32	19 deg.	9 deg.
.5000	.0005	1 5/16	.0002	11/16	.010	25 deg.	7 deg.	1/32	19 deg.	9 deg.
.5312	.0005	1 5/16	.0002	11/16	.010	22 deg.	7 deg.	1/32	19 deg.	9 deg.
.5625	.0005	1 5/16	.0002	11/16	.010	22 deg.	7 deg.	1/32	19 deg.	9 deg.
.5937	.0005	1 5/16	.0002	11/16	.010	22 deg.	7 deg.	1/32	19 deg.	9 deg.
.6250	.0005	1 9/16	.0002	11/16	.010	22 deg.	7 deg.	1/32	16 deg.	8 deg.
.6562	.0005	1 9/16	.0002	11/16	.010	22 deg.	7 deg.	1/32	16 deg.	8 deg.
.6875	.0005	1 9/16	.0002	11/16	.010	22 deg.	7 deg.	1/32	16 deg.	8 deg.
.7187	.0005	1 9/16	.0002	11/16	.010	22 deg.	7 deg.	3/64	16 deg.	8 deg.
.7500	.0005	1 13/16	.0003	11/16	.010	22 deg.	7 deg.	3/64	16 deg.	8 deg.
.7812	.0005	1 13/16	.0003	11/16	.015	22 deg.	6 deg.	3/64	16 deg.	8 deg.
.8125	.0005	1 13/16	.0003	11/16	.015	22 deg.	6 deg.	3/64	16 deg.	8 deg.
.8437	.0005	1 13/16	.0003	11/16	.015	22 deg.	6 deg.	3/64	16 deg.	8 deg.
.8750	.0005	1 15/16	.0003	11/16	.015	20 deg.	7 deg.	3/64	16 deg.	8 deg.
.9062	.0005	1 15/16	.0003	11/16	.015	20 deg.	7 deg.	3/64	16 deg.	8 deg.
.9375	.0005	1 15/16	.0003	11/16	.015	20 deg.	7 deg.	3/64	16 deg.	8 deg.
.9687	.0005	1 15/16	.0003	11/16	.015	19 deg.	6 deg.	1/16	16 deg.	8 deg.
1.1000	.001	2 1/16	.0003	11/16	.015	19 deg.	6 deg.	1/16	16 deg.	8 deg.
1.0625	.001	2 1/16	.0003	11/16	.020	19 deg.	6 deg.	1/16	16 deg.	8 deg.
1.1250	.001	2 1/16	.0003	7/8	.020	19 deg.	6 deg.	1/16	15 deg.	6 deg.
1.1875	.001	2 1/16	.0003	7/8	.020	19 deg.	6 deg.	1/16	15 deg.	6 deg.
1.250	.001	2 1/8	.0003	7/8	.020	17 deg.	5 deg.	1/16	15 deg.	6 deg.
1.3125	.001	2 1/8	.0003	7/8	.020	17 deg.	5 deg.	1/16	15 deg.	6 deg.
1.3750	.001	2 3/8	.0003	7/8	.020	17 deg.	5 deg.	3/32	15 deg.	6 deg.
1.4375	.001	2 3/8	.0003	7/8	.020	17 deg.	5 deg.	3/32	15 deg.	6 deg.
1.5000	.001	2 5/8	.0003	7/8	.020	17 deg.	5 deg.	3/32	15 deg.	6 deg.

*The above information applies only to the chucking reamers—excluding reamers with carbide full length of flute.




PREPARATION OF LEAD ANGLE FOR SMOOTH FINISH ON HARD STEEL
2°
A
SHARPEN TO SHARP EDGE
F
E
LENGTH "A" ... DIAMETER OF TOOL TO A MAXIMUM LENGTH OF ... INCH
FOR DIMENSIONS F & E SEE TABLE
SHARPENING DETAILS FOR SELF-PILOTING REAMER
CYLINDRICAL GRIND ONLY TO REQUIRED DIAMETER
45°
A
SHARPEN PER DIMENSIONS J & H (ABOVE TABLE)
GRIND DIAMETER "A" .002 — .005 UNDER ROUGH HOLE SIZE

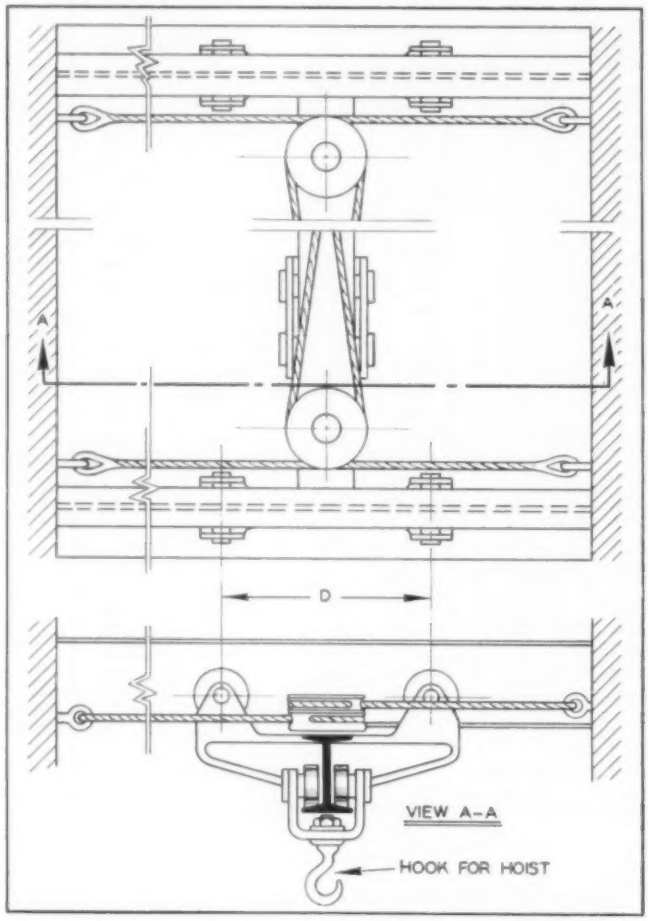
Courtesy Wendt-Sonis Company

GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Equalizing a Crane Trolley

In our plant, a simple overhead crane was designed to handle a specific job. The tracks consisted to two parallel I-beams, the ends of which were supported at the building walls. The carriage or traveller, which consisted of another I-beam mounted on two trolleys running on the two parallel tracks, mounted a single trolley which, in turn, carried a hoist from which the load was suspended. The traveller, with its load, was moved by hand.



The carriage of a travelling crane can be equalized by means of flexible cables looped around sheaves. (Okerfors)

To enable the traveller to get close to the wall, the distance "D" between trolley wheels was held as close as practically possible. However, this had the effect of cocking the traveller, especially if the load was too close to one of the main tracks. Rather than build an expensive equalizing mechanism, we improvised with a method "borrowed" from the cord-operated drafting table straight-edge.

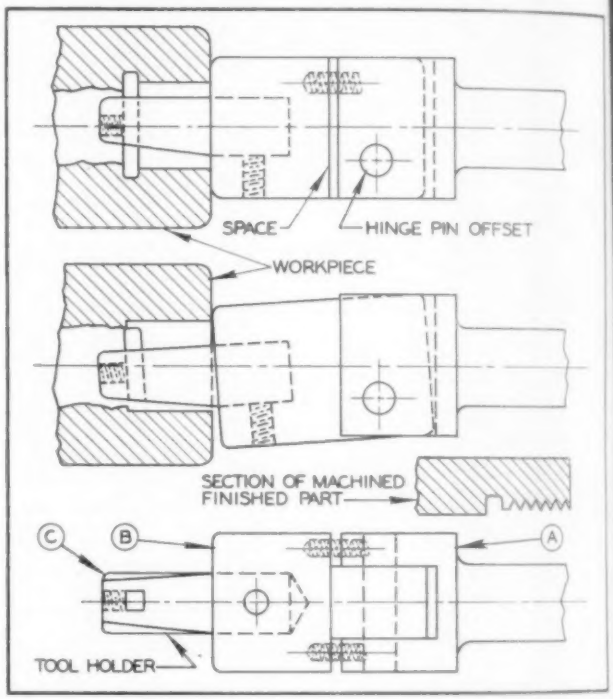
This consisted of mounting grooved sheaves over each of the two main trolleys. Screwed into the walls, and adjacent to the main tracks, were four eye-bolts. A length of flexible steel cable was then hooked through one of the eye-bolts, run over two opposite sheaves, and in turn attached to the opposite diagonal eye-bolt. A second steel cable was strung in the opposite direction and, after the carriage was carefully squared, secured to the diagonally opposite eye-bolt. The crane now operates freely on the tracks and any stretch of the cables can be adjusted by drawing up on the eye-bolts.

Ingvar Okerfors, Peoria, Ill.

"Automatic" Recessing Tool

Having to machine a considerable number of castings of recurrent lots in which a turret lathe operation called for boring, recessing and tapping a cored hole, the recessing was greatly simplified by the tool illustrated.

The tool consists essentially of a shank or body (A) which is slotted slip fit for rocker (B), and a tool holder (C), the latter broached for a square tool bit although a round will do. The rocking member (B) swings on a below-center offset hinge pin, and, so as not to depend entirely on gravity, is held in receded or "down" position by two compression springs.



Bores may be recessed, with the tool shown, by merely advancing it against the face of the workpiece. Withdrawing retracts the tool bit. (Spicer)

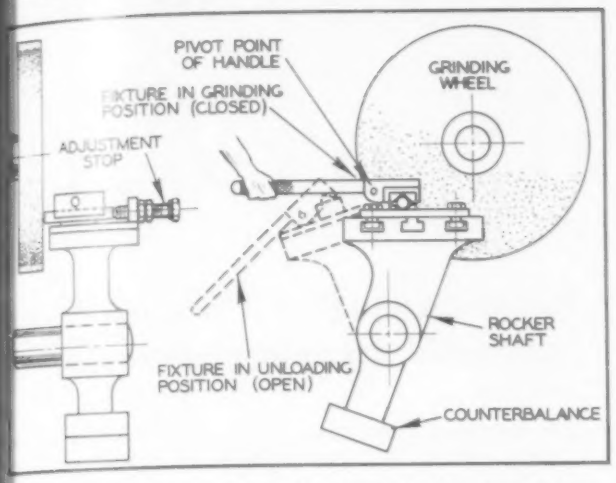
Operation is simple. The hole is first bored to required depth and the end of the part faced. The recessing tool is then advanced. As the end of the rocking member comes in contact with the face of the part, pressure causes it to rise or straighten with the advance of the lathe turret, in turn advancing the tool bit into the desired recess. The depth of cut can be regulated by the turret stops. On backing away the turret, the rocking member drops down until the tool bit clears the bore.

The main components—A, B and C—are made of machine steel, with the latter pack hardened or hard faced for wear. Naturally, proportions of the components will depend on the size of the work and depth of bore. What is shown here is the working principle of the tool, which served very nicely for the job for which it was designed.

Chas. G. Spicer
Grand River Valley Chapter, ASTE

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

End Finishing Attachment



A fixture mounted on the swinging table of a grinder facilitates squaring ends of cut-off stock. (Lindberg)

Parts cut off from bar on automatic screw machines may have a burr which may require secondary work for any of the following reasons: to hold a closer overall length than can be maintained on the automatic; to maintain close relationship of end to a shoulder; to maintain close squareness of body to face; to insure a good finish on the end; or to quickly remove cut-off burr from the part.

There are many methods which affect these purposes. For the average run of such work, however a fixture mounted on the swinging table of a No. 5 Gardner (or comparable) grinder will serve for all of the purposes stated. The weight of table and fixture being counterweighted insures maximum movement with a minimum of operator fatigue.

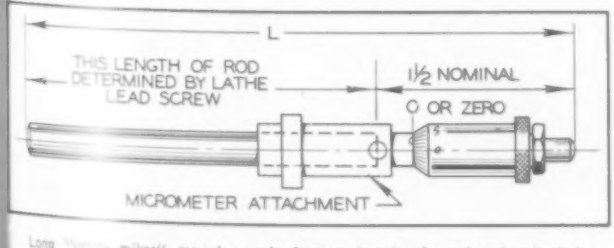
The fixture shown, of which the drawing may be considered self-explanatory, can be made universal by proper design, which in turn implies a mimimum of interchangeable parts. The adjustable stop can further be improved for shorter parts by incorporating a spring push-out, which would automatically eject the parts as the fixture clears the wheel. In our plant, production with an experienced operator has reached 1200 pieces per hour; however, an average of 900 per hour can be maintained. About the closest tolerance that can be held on production runs is 0.004 in.

Herbert C. Lindberg
New Britain, Conn.

Making a Measuring Rod

When a dimension is to be measured that is beyond the range of available gage blocks, verniers or other calipers, a fairly accurate measuring rod may be made by using a toolroom lathe having an accurate lead screw.

Proceed as follows: Select a gear ratio that will produce the desired linear dimension is a known number of full revolutions of the spindle. Then, with a surface gage, scribe a line on the outer periphery of the lathe face plate. Use this line for indexing.



Long "micrometer mikes" may be made from a length of steel rod extended with a standard micrometer attachment. (Maley)

After taking up the backlash, bring the lathe micrometer stop up to the carriage. Then move the carriage along the ways as in threading, when the correct number of turns of the face plate will produce a dimension between the anvil of the micrometer stop and the carriage. Lock the carriage.

The distance between carriage and micrometer stop can now be used to measure the length of a rod which has been ground or faced square on the ends. Normally, the accuracy will be determined by the accuracy of the lead screw and the care taken to allow the rod to cool to room temperature after facing the ends.

T. H. Maley
Hartford, Conn.

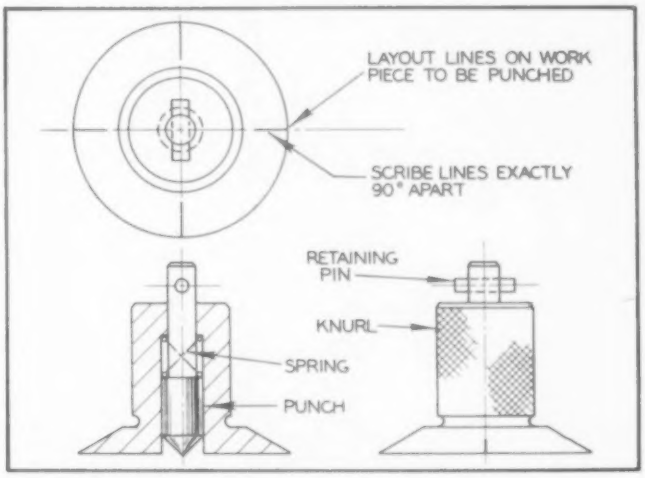
While the method referred to by Mr. Maley is entirely practical within reasonable limits of tolerance, there is the disadvantage that the rod so gaged is rather inflexible as to length. By making a rod to the nearest ¼ in. of length, less the zero gage length of a micrometer attachment, and attaching the latter to the rod, as illustrated, one obtains what to all practical purposes is a long inside micrometer.

For example, if a rod of total length (L) 40 in. is required, then the rod should be made 38.25 in. long. Assume, then, that the length of a standard micrometer attachment from anvil to end is 1½ inches, the total for L, with the micrometer in shut position, would be 39.75 in. As the attachment opens ½ in., one has a range from 39.75 to 40.25 in.

The Gadget Editor

Jig Aids Center Punching

Center marks can be accurately punched at the exact intersection of two layout lines with the jig illustrated. The body is made from a round section of tool steel, which should be hardened. One end is turned down and knurled for gripping; the other end is tapered to about a 30 deg angle. A stepped hole is reamed in the exact center and the bottom of the body is ground flat and at right angles to the hole. Four gage marks are scribed on the beveled edge of the body exactly 90 degrees apart by using a standard milling machine indexing head.



Intersecting scribed lines may be accurately center punched by matching them with the gage marks on the punch body. (Isetts)

The center punch itself is also made from a good grade of tool steel, hardened and ground on the O.D. and on the point. A small retaining pin is pressed in near the top after it is assembled. To use, lay the jig on the work so that the four scribed marks line up with the layout lines. Then, a sharp blow on the top of the punch with a hammer will produce an accurately centered mark.

Roger Isetts
Kenosha, Wis.

What's Ahead for

Free

Economists to Debate Business Pattern
Additional Exposition Area Opened

WHERE IS the economic system of America heading? Toward a rallying of free enterprise? Or into stricter government control? What's the best course for business today? Why?

Between now and April 10 industrialists all around the country will be pondering these questions. For on that evening they've been invited to sit in on the ASTE Economic Forum highlighting the Society's 18th Annual Meeting and Industrial Cost Cutting Exposition at Philadelphia.

Four top-flight U. S. economists will take the stage at the Academy of Music to give their views. They will discuss each other's outlook, answer questions from the audience and debate these opinions. Their conclusions may form a pattern for tomorrow's business.

In addition to the members, exhibitors and guests assembled in the Academy auditorium, thousands more may listen to this probing into the future of industry, through one of its greatest achievements —the mass production radio.

Fuller Is Keynoter

After Robert B. Douglas of Montreal, ASTE president, welcomes the distinguished gathering, Paul Wooton, president of the Society of Business Magazine Editors, and secretary-treasurer of the White House Correspondents' Association, will take over as master of ceremonies.

Walter D. Fuller, president and director, Curtis Publishing Co., Philadelphia, and vice-chairman, Committee for Economic Development, will keynote the forum.

Economists composing the panel are: Dr. Edwin G. Nourse, recently chairman of the Council of Economic Advisers to the President; Dr. C. Canby Balderston, dean, Wharton School of Finance and Commerce, University of Pennsylvania, and professor of industry.

Edward T. Cheyfitz, labor economist and former adviser to the CIO and the War Production Board; and Joseph A. Livingston, financial editor, *Philadelphia Bulletin*, and author of *Business Outlook*, a widely syndicated newspaper column.

Tops in Their Field

Individually and collectively these men have a wealth of economic know-how. Mr. Wooton is probably more familiar with the shifting relations between government and industry than almost any other man in the U. S.

He is a past president of the National Press Club, largest editorial organization in the world, of the White House Correspondents' Association, and the Overseas Writers. In the technical field the Washington Society of Engineers has honored him with its presidency.

Abroad, he is a member of the London Press Club, was decorated in wartime by the Norwegian government. For years he was chief of the McGraw-Hill Washington Bureau, now serves on the editorial board of the Chilton Co.

Mr. Fuller is widely known in the pub-

From top: "Proclaim liberty throughout all the land unto all the inhabitants thereof," reads the inscription on America's symbol of democracy, in Independence Hall where the Declaration of Independence and the Constitution were signed. Carpenters' Hall, headquarters of the first labor organization in the U. S. and meeting place of the First Continental Congress, invites visitors through the courtyard gates on Chestnut Street. On the opening night of the ASTE convention industrialists from all over America will gather at the home of the Philadelphia Orchestra to hear what the country's leading economists predict for the future of business. Below: From his comfortable position at the base of the Washington statue in Benjamin Franklin Parkway, an American aborigine gazes over the city whose founder made the only Indian treaty "never sworn to and never broken." Photos courtesy of Philadelphia Convention and Visitors Bureau.

Enterprise?

in Forum at Society's Philadelphia Convention to Accommodate 321 Firms Exhibiting at April Show

By Doris B. Pratt

lishing world not only in his business capacity but also as chairman of the National Association of Magazine Publishers, Inc.

A believer in close industry-community relations, he heads the Committee on Cooperation with Community Leaders and holds the Poor Richard Gold Medal.

W. D. Fuller

E. G. Nourse

In addition he finds time to serve as director and trustee of a bank, insurance companies, civic organizations, and educational institutions. He is also a director of the Foundation for American Agriculture and president of the Farm Film Foundation. In 1946 the President of the United States recognized his contributions to American economic life with the Medal of Merit.

As a founder and former vice-president of Brookings Institution, Dr. Nourse participated in a series of studies on national production and income. They range from "America's Capacity to Produce" to his latest Brookings publication, "Price Making in a Democracy."

Nourse Was U. S. Delegate

Other posts he has held include the presidency of the American Economic Association and the American Farm Economic Association. Twice he served as U. S. delegate to the International Institute of Agriculture. And he represented this country on the Committee on Nutrition of the League of Nations.

From an economic standpoint Dr. Balderston is considered an outstanding authority on industrial relations. He has written comprehensive studies on management problems, is affiliated with most of the major associations concerned with economics. He is a director of the Philadelphia branch of the Federal Reserve Bank and of Leeds-Lippincott Co. During the war he was chief of the War Department Wage Administration Agency and of the Wage Administration Section, Army Service Forces.

From membership in a local at Doehler Die Casting Co., Toledo, Mr. Cheyfitz shot to the top in the CIO. He is the youngest man ever elected to its National Executive Board. He distinguished himself as one of the proponents of the widely-heralded Toledo Labor-Peace Plan.

Serves on CED Special Committee

Following service in the U. S. Army Air Corps he was named Labor Consultant to the War Production Board. The CED recently made him secretary of the Special Policy Committee on Collective Bargaining, a group which has conducted a sweeping survey of industry relations in America. He is now assistant to Eric Johnston, president of the Motion Picture Association. "Constructive Collective Bargaining" is one of his best-known writings.

For his knowledge of business economics acquired through editorships of financial papers, Mr. Livingston was drafted by the War Production Board and subsequently by the Office of War Mobilization and Reconversion. While in the former agency he became Economic Assistant to Chief of Operations. He wrote the Public Affairs pamphlet, "Reconversion—the Job Ahead," contributes to consumer and business periodicals.

Will business slump, boom, or continue at present levels? Will taxes go up or down? Can management and engineers make output per manhour keep pace with union wage demands? How can American heavy industry get its share of foreign business?

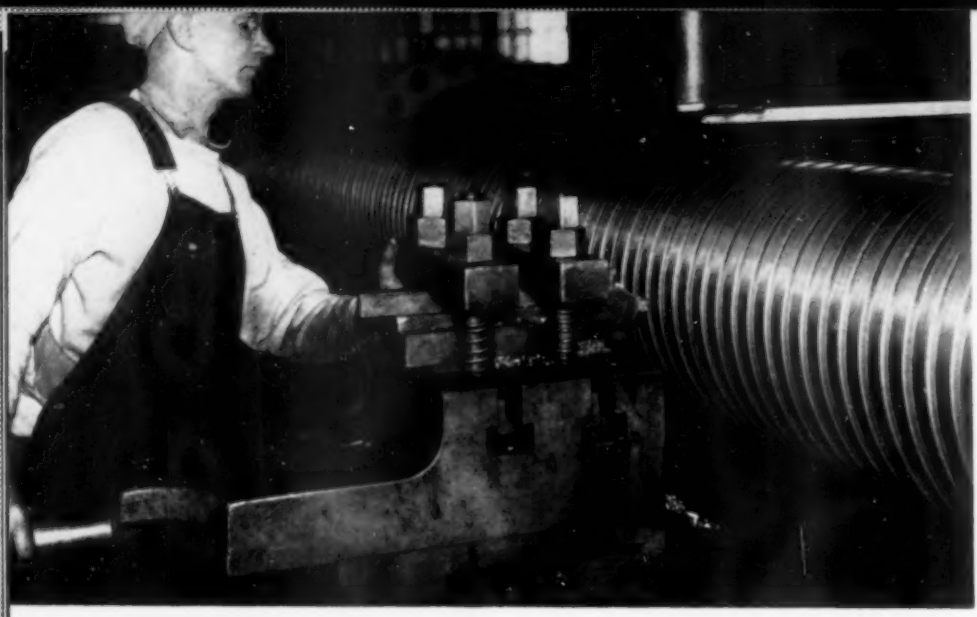
Will the hydrogen bomb panic drive industry underground? Disperse it? Where?

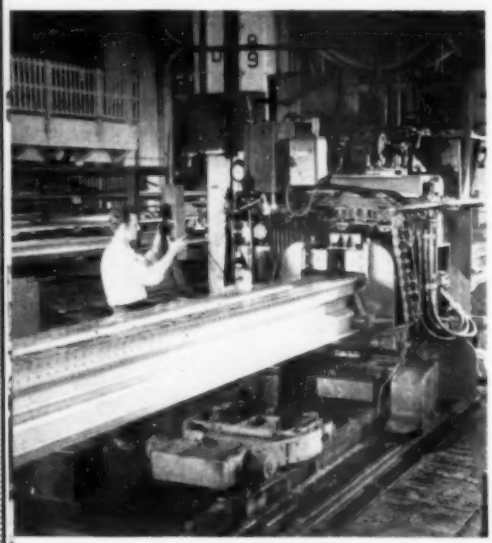
Do you know? Neither do we. But we hope this panel of experts can come up with answers to some of the problems plaguing business—answers that will help you in your job of producing the best for the least.

A committee of publishers arranging the forum includes Joseph S. Hildreth, president, Chilton Publishing Co., Philadelphia, as chairman; E. L. Shaner, chairman and treasurer, Penton Publishing Co., Cleveland; and Robert B. Luchars, president, The Industrial Press, New York City.

Whatever the pessimistic viewers-with-alarm fear, there will be lusty competition at the ASTE Exposition. Here

In 1776 George Washington called at this Arch Street house to ask Betsy Ross to make our first national emblem. Until 1857 a daughter of Mrs. Ross continued her mother's contract to supply all government flags. Today, employees of the Philadelphia Quartermaster Depot's Manufacturing Division embroider a flag for Secretary of Defense Louis A. Johnson. Photos courtesy of Philadelphia Convention and Visitors Bureau and the Philadelphia Quartermaster Depot.





the prospective buyer of equipment to counter these threats to his business can shop around to find the newest method, the best machine, the lowest price.

He can watch demonstrations, get technical advice from exhibit attendants, compare notes with fellow production men. He won't be elbowed out by sightseers or literature collectors because they won't be there. The five-day show is strictly invitational and everybody present will have some legitimate interest in the metalworking industry.

Although some exhibitors are keeping mum about their feature attractions, you can expect to see innovations and refinements in just about every method, process, operation and service used in the machine tool field. Improved optical inspection instruments . . . automatic sorting devices . . . coordination of milling machine operations through sound . . . a heavy duty machine to stamp impressions on metal . . . operating panels of valves . . . a self-contained cam milling machine . . . something new in hole punching.

But not all the new developments to be shown are products of Yankee mechanical genius. Surprises in high precision equipment are expected from abroad, too.

Applications of some of the products exhibited may be seen in a showing of selected films at the theatre adjoining the exposition buildings. A five-hour program will be projected daily in two parts, at 9:30 a.m. and 1:30 p.m.

The Society's own exhibit will be one of the most attractive. It will document graphically the organization's activities and membership benefits. Headquarters personnel will render membership services, explain Society functions and assist ASTE'ers in locating other visitors. Another group from the Detroit office will be assigned to the registration desk.

Expect 30,000 to Register

As we go to press the big mail room at Headquarters is piled high with show invitations, registration forms, badges, pocket programs, hotel reservation blanks and other literature. Addressing and mailing machines run steadily, processing this mammoth broadside of exposition and convention information. More than half a million invitations will be issued by the Society and its exhibitors.

President Douglas, exposition chairman, and his committee, First Vice-President H. L. Tigges and Treasurer G. A. Goodwin anticipate a registration of between 30,000-35,000, with an attendance of several times this estimate.

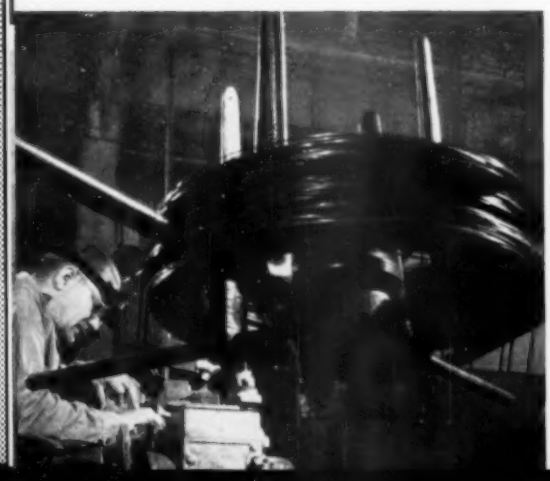
Demand for show space exceeds the original floor plan, ASTE Executive Secretary Harry E. Conrad, manager of the exposition, has announced. Another section of Convention Hall is being opened to accommodate the overflow of exhibitors. J. V. Friel of Reber-Friel Co., Philadelphia, is operating show manager, in charge of physical arrangements. Show hours are from 9:00 a.m. 5:00 p.m., Monday through Friday.

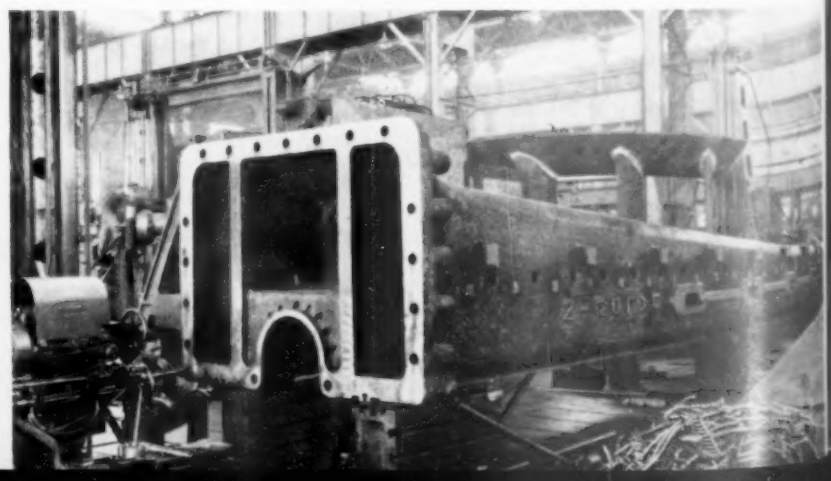
A complete list of the 321 exhibitors participating, as of press time, appears on Pages 58 and 59.

On the Annual Meeting side, the National Program Committee is sponsoring 18 technical sessions, emphasizing the cost-saving theme. They make up one of the most intensive and varied ASTE programs ever presented.

Responsibility for lining up the 2[illegible] speakers has been shared by Fred J. Schmitt of D. A. Stuart Oil Co., Chicago, committee chairman; Kenneth W. Riddle

From top: The machining of this 35,000-lb screw, one of four designed for a 5,000,000-lb universal testing machine, is characteristic of operations ASTE members will see in a tour of Baldwin Locomotive Works. At SKF Industries gleaming steel rings frame an operator machining a new anti-friction railroad journal bearing with carbide tools. As this automatic welding machine at The Budd Co. joins three stainless steel sections, it forms a railway car backbone strong enough to withstand pressures up to 1,800,000 lb. An SKF worker guides a machine converting a reel of wire into countless little ball bearings. Below: A Baldwin employee bores the base of a 40-ft steel casting, one of two supporting columns of a mammoth testing machine for the U.S. Bureau of Reclamation at Denver.





of Drexel Institute of Technology, Philadelphia member of the committee; and Frank W. Wilson of ASTE Headquarters, handbook editor and technical director.

The kickoff meeting Monday afternoon is a session on Developments in Press-working of Metals. R. B. Schulze, general supervisor of manufacturing research, The Glenn L. Martin Co., Baltimore, Md., will explain Forming Sheet Metal by the Marform Process. This economical method is claimed to meet requirements of compound curvatures and deep-drawn flanges, with little or no wrinkling or springback.

George F. Eglinton, vice-president, Lincoln Park Industries, Lincoln Park, Mich., will follow with a report on Carbide Die Developments. In showing specific examples of savings effected through carbide applications, he will deal with high precision and blanking dies, rather than the conventional draw work ordinarily associated with carbide dies.

To Reveal German Developments

Some of the German technical know-how confiscated as war reparations will be disclosed during a concurrent meeting, Cold Extrusion of Metals. J. P. Bowden, engineer at Heintz Mfg. Co., Philadelphia, will relate the origin of steel extrusion at room temperature and applications of extensive cold working to military and other components in Germany and the U. S.

A veteran in the automotive industry from its infancy, C. M. Franklin, master mechanic, Rochester Products Div., General Motors Corp., Rochester, N. Y., will present the Tuesday morning lecture, Design and Use of Die Casting Dies. Automobile accessories such as fuel pumps, carburetors and locks require high precision and intricate dies. Mr. Franklin, who formerly headed the Die Casting and Plastics Sub-Committee of the General Motors Master Mechanics Group, is an expert in this field.

Another specialist in automotive tooling will appear on the afternoon program. In Automation of Ground and Turned Production Parts, Nevin L. Bean, chief design engineer, Automatic Transmission Program, Ford Motor Co., Detroit, will inform tool engineers how parts can be handled with a minimum of human effort. The valve guide bushing is the part Mr. Bean will consider. More than 100,000 pieces of this perishable item are produced daily at Ford's. The ASTE audience will be able to follow the processing and handling of this high production part from raw material to disposition of the final product.

Increasing demands for metal applications requiring high heat resistance will draw heavy attendance to a lecture on Machining and Fabrication of High Temperature Alloys.

Beginning with a discussion of high temperature applications in aircraft superchargers and gas turbines, Charles L. Sadon, manufacturing engineer, Aircraft Gas Turbine Div., General Electric Co., West Lynn, Mass., will tell how to forge such alloys. Then he will go into methods of fabricating and welding sheet metal parts, concluding with the machining of high temperature materials.

Roy T. Hurley, president, Curtiss-Wright Corp., Wood-Ridge, N. J., believes that higher speeds and feeds offer an opportunity to materially increase production and decrease manufacturing costs. He will show how to effect such economies in a talk on Machinability, Tuesday evening.

To take advantage of these savings, Mr. Hurley says, machinability of the material to be cut should be understood and controlled and the machine tool should be properly fitted. His paper will be concerned with requirements to be considered.

Unconventional Drilling Method

Two authorities will bring Society members up-to-date on Trends in Drilling.

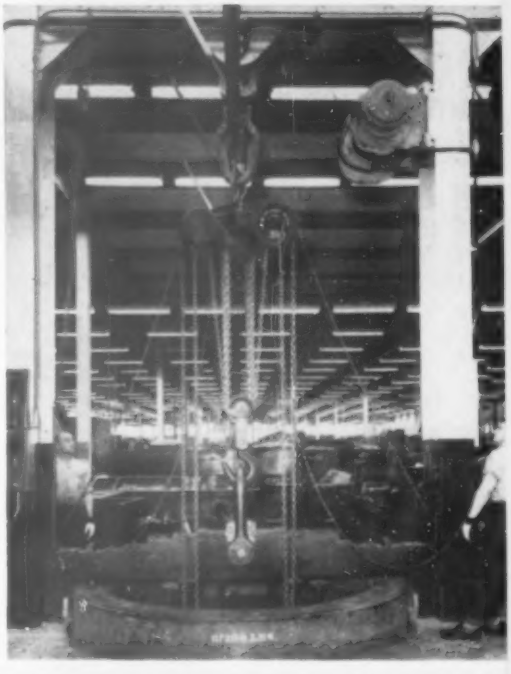
Eugene Numrich, application engineer, Avey Drilling Machine Co., Cincinnati, will detail the Application of Drill Units to Standard and Special Machinery. Experienced in solving production problems for manufacturers, Mr. Numrich will emphasize how ingenuity in utilizing drilling and tapping units will adapt special and even standard machines to a particular job.

How one company's independent approach to a machining operation brought about an unconventional process forms the theme of the accompanying talk, Micro-Drilling.

An inventor and manufacturer in this field, John A. Cupler II, general manager, National Jet Co., Cumberland, Md., will show the claimed superiority of the new method. He will compare accepted practice with the new, explore drill making and drilling, describe the operating principle and advantages of the newly designed drilling equipment. Using this method, uniform holes as small as 0.0020 in. may be drilled in stainless steel without undue hazard to the drill or severe nervous strain on the operator.

If you're stumped for materials in parts affected by corrosion, high temperatures, excessive friction, wear or galling, don't miss the Wednesday morning session, Metamics.

W. O. Sweeny, Jr., assistant sales manager, Haynes-Stellite Div., Union Carbide & Carbon Corp., Kokomo, Ind., will tell how combining metals and ceramics by powder metallurgy techniques



Right, from top: The welded roof of a stainless steel railway car is equipped with air conditioning, insulation, and wiring at The Budd Co.'s Red Lion plant. A tense moment as two workers test hand chain hoists to 50 percent above rated capacity at Yale & Towne Mfg. Co. Power tools are extensively used in Philco television production operations to speed the assembly of small components to the metal sub-base of the receiver chassis. Below, left: A Link-Belt press drive is tested at the company's Philadelphia plant.

Left, from top: "Battleship X of World War II," the mighty USS South Dakota, rests at her berth with the Philadelphia Group of the Atlantic Reserve Fleet at the Philadelphia Naval Base. Downtown traffic swirls around, in and through the City Hall, 549 feet below the statue of William Penn, founder of the "greene countrie towne." ASTE will elect its officers and directors at the Benjamin Franklin Hotel, site of the old Continental Hotel where Edward VII and Charles Dickens once stopped. Above: The Rodin Museum is filled with originals, recasts, paintings and drawings by the French sculptor of the same name. Photos courtesy U.S. Navy, Benjamin Franklin Hotel and Philadelphia Convention and Visitors Bureau.

produces a new material with higher physical and chemical properties than either of its components.

Besides enumerating the qualities of this unique material, Mr. Sweeny will recommend methods of joining metal ceramics to themselves and to other materials, how to machine and grind them, what shapes and sizes can be made.

Limitations and Possibilities of Cold Roll Forming of Metals may solve some of your production problems after you hear Elmer J. Vanderploeg, assistant chief engineer, The Yoder Co., Cleveland, on Wednesday afternoon. Items unique to this field may be produced with cold roll forming machines in combination with other equipment. And by better product design cold rolling can be used more extensively. Mr. Vanderploeg will also discuss design and manufacture of tooling, and possible new fields of application.

In a second session on Automation, the subject will be treated from two angles—forging and heat treating, and press room. T. E. Darnton, supervisor of standards, and W. L. Mautz, supervisor of production engineering at the Oldsmobile Forging plant of General Motors Corp., Lansing, Mich., will handle the first phase.

Forgings Handled Automatically

These speakers will point out advantages of induction furnaces in heating forging stock. They will compare merits of forging presses and drop hammers for most efficient application, and describe the automatic handling of tons of forging parts constantly moving from the forges through furnaces, pickling baths and shot peeners.

Herman F. Zorn, president, The V & O Press Co., Hudson, N. Y., and a familiar figure on ASTE chapter platforms will consider the application of automatic roll, dial, bar and grip feeds to presses, as well as transfer motions, hoppers and safety devices.

Wednesday evening there will be a film lecture depicting Tooling Up for Modern Truck Engine Production. Joseph Olender, mechanical engineer, International Harvester Co., Indianapolis, will narrate a film and slides showing planning for flow of materials from machining lines to assembly, automatic gaging, latest type line transfer, and single-purpose automatic machinery. Tool control stations and other features for facilitating tool changes will be included in this presentation.

How to Sell Tooling to Management

Difficulty in securing top management's cooperation on a well planned tool program lies in not selling it in terms of dollar production savings, in the experience of a firm of management engineers. So Norris M. Perris and H. K. Keever, partners, Stevenson, Jordan & Harrison, Inc., New York City, will explain the Use of Element Time Data for Effective Tool Design. Their method of projecting this plan enables manufacturers to quickly evaluate tools and to secure maximum production from machine tools, jigs, fixtures and special holding devices.

Hard Surfacing of Production Tools and Gages comes up for consideration Thursday morning. J. G. Morrison, chief metallurgist, Landis Machine Co., Waynesboro, Pa., opens the meeting with Nitriding of High Speed Steel Tools and Gages. While the process is not new, past experience convinces Mr. Morrison that it may be extended to tools not previously nitrided. Means of accomplishing relatively deep nitride cases and of diminishing the brittleness of the nitrided surface form the basis of his paper.

B. A. Taylor, vice-president, Chrome Electro-Forming Co., Detroit, will continue with a lecture on Hard Chrome Plating, concerning the advantages of plating to size on thread gages, ring gages, taps, and powdered metal dies without subsequent grinding or other finishing operations.

An ASTE member who was instrumental in developing the successful broach rifling machine will be introduced at an afternoon session on Broaching

pplications for Cost Reduction. Oliver . Bonnafe, chief research engineer, The apointe Machine Tool Co., Hudson, Mass., will tell how broaching can effect avings in the automotive, aircraft and ousehold appliance fields.

Realizing industry's need for auto- atic parts handling equipment and utomatic assembly machines, C. E. Kraus left a post as research director for machine manufacturer in 1944 to make uch equipment. As president of Kraus esign, Inc., Rochester, N. Y., he will ive tool engineers data on Automation Hopper Feeds for Assemblies. Mr. Kraus will detail the automatic handling f small workpieces in assembly, machin- g, packaging and sorting operations nd the mechanical problems involved.

Will Cite Design Case Histories

Design Economics heads up the Friday rogram. John VanHammersveld, super- isor, Design Cost Control Group, The Glenn L. Martin Co., Baltimore, Md., ill use two case histories to illustrate he design influence on material selection nd combination of materials to achieve he best design for manufacturing. By pplying design bulletin information and ost control techniques aligned with effi- ient functional engineering, he will how the conception of the design pro- ression cycle.

T. F. Frangos, sales engineer, Haynes- tellite Div., Union Carbide & Carbon Corp., Kokomo, Ind., will offer a realistic pproach to Investment Casting, en- bling engineers to evaluate the process nd to design for the best applications. fter a minute description of the process, Mr. Frangos will point out the scope of recision casting. Then design consid- rations will be carefully analyzed.

Distinguished in industry, science and ducation in this country and abroad, r. Max Kronenberg, Cincinnati con- ulting engineer, can speak with author- ty on the Effect of Latest American tandards on Lathe Spindle Deflections. esistance to deformation has not been onsidered heretofore in standardizing pindle noses for toolroom and engine athes, says Dr. Kronenberg.

In view of the growing significance of igidity in machine tools and the effect accuracy of production, freedom from ibration, and tool life, he has prepared analysis of spindle nose deflections ecommended in ASA bulletin B5.9-1948.

The two latter speakers will appear on e closing sessions Friday afternoon. he technical sessions open throughout the week at 9:00 a.m., 2:00 p.m., and 8:00 p.m. Daytime meetings will be at Convention Hall. Evening sessions will be held Tuesday and Wednesday at the Benjamin Franklin and Bellevue-Strat- ford hotels.

Chairmen for the technical sessions are: Arthur R. Diamond, A. C. Jackson, Campbell Pittsinger, D. J. Heckinger, John Whitesell, J. R. Weaver, C. F. Stephenson, Eric Lund, P. A. Patterson, Frank J. DeFrates, Dwight Renfrew, Edmond Hollingsworth and Emil Kitz- man, all of Philadelphia.

Other session chairmen are: J. O. Horne, Rochester, N. Y., Gardner Young, Pittsburgh, Pa., A. H. d'Arcambal, Hart- ford, Conn., H. S. Hunt, Ridgewood, N. J., and G. A. Rogers, Montreal, Que.

* * *

Plant tours are always a high spot at ASTE conventions. Philadelphia will be no exception.

Nine companies will each host the So- ciety and its guests for four tours. Buses will leave Convention Hall at 9:00 a.m. and 1:00 p.m., every day, returning three hours later.

Visitors expecting to see only Diesel and steam railroad engines at Baldwin Locomotive Works will be astonished at the versatility of this plant. Electronic strain gages no larger than a postage stamp and testing machines of 5,000,000 lb capacity are taken in stride here.

Massive hydraulic presses for metal and plastics forming, 20-ft bronze ship propellers, and hydraulic turbines for power dams are other products. Ma- chining and handling such immense equipment presents interesting problems.

Output from the Steam Division of Westinghouse Electric Corp. runs the gamut in size, too. So do the tools.

Turbines of 3 to 220,000 hp, con- densers with 100 to 130,000 sq ft of cool- ing surface, and gears of comparable proportions are made in the Philadelphia plant.

All Operations on Stainless Steel

In addition to ordinary-sized tools, there is a 160-in. lathe, a 200-in. gear cutting machine, a 7500-lb drop hammer, a million-volt X-ray machine, a 125-ton balancing machine, and 16-ft planers.

For the engineer intent on studying stainless steel processing, a trip through the Red Lion plant of The Budd Co. will be a field day. Budd was a pioneer in forming this tough material into exact- ing patterns for light-weight railway cars and truck trailers.

Coil steel is rough sheared, then bent, corrugated or cut, according to the part. Manually operated and power hammers bang the parts into shape. Then they are checked on scribe fixtures. If the contour does not conform, the operator must pound the piece some more. Special techniques have been evolved for ma- chining the rugged metal.

For the latest in plant layout join the trip to the brand new factory of Yale & Towne Mfg. Co. As one feature of the improved setup, the general machine shop is divided into seven departments, by types of machine tools. Production in economical quantities is routed ac- cordingly. A special machine shop handles small runs and parts not suited to the high-volume equipment in the general machine shop.

This plant makes good use of its own products in manufacturing hand and electric hoists, scales, hand and power industrial trucks for customers.

Bearings Up to 5100 Pounds

At one end of the production scale at SKF Industries, Inc., ASTE members will see tiny steel pellets for ball-point pens, each within a few millionths of an inch of being perfectly round. It takes 7000 to make an ounce. By weight they are as precious as gold.

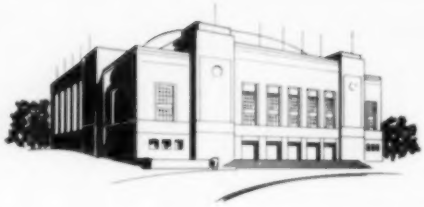
At the other extreme SKF turns out 5100-lb, spherical roller bearings to do heavy work in steel, aluminum and paper mills. In between are several thousand sizes of a half-dozen or more types. All require high precision machining and in- spection operations.

From cookies to castings American industry moves on its conveyors. The ingenuity required to adapt such equip- ment to almost every field of production will impress those who inspect the facil- ities of Link-Belt Co.

(Continued on Page 60)

Elfreth's Alley, oldest existing street of the 1700 period, will rouse itself for its annual street dancing in June.

est place in Philadelphia will be Convention Hall e more than 300 exhibitors set up attractive splays of new tooling equipment at the Society's l-Cutting Industrial Exposition.



Exhibitors

ACCURATE BUSHING CO.
Garwood, N. J.
ACE ABRASIVE LABORATORIES
New York, N. Y.
ACME STEEL CO.
Chicago, Ill.
ACME TOOL CO.
New York, N. Y.
ACME WINTER CORP.
Buffalo, N. Y.
ADEL PRECISION PRODUCTS CORP.
Burbank, Calif.
AIRBORNE ACCESSORIES
Hillside, N. J.
AIR SPEED TOOL CO.
Los Angeles, Calif.
AJAX ELECTRIC CO., INC.
Philadelphia, Penn.
ALLEGHENY LUDLUM STEEL CORP.
Pittsburgh, Pa.
THE ALLEN MFG. CO.
Hartford, Conn.
ALLIED PRODUCTS CORP.
Detroit, Mich.
ALLISON CO.
Bridgeport, Conn.
ALPHA CORP.
Greenwich, Conn.
AMERICAN MACHINE & FOUNDRY CO.
Wahlstrom Tool Div.
Brooklyn, N. Y.
AMERICAN PULLMAX
Chicago, Ill.
AMERICAN SOCIETY OF TOOL ENGINEERS
Detroit, Mich.
B. C. AMES CO.
Waltham, Mass.
AMPCO METAL, INC.
Milwaukee, Wis.
AMPLEX MFG. CO.
SUBS. CHRYSLER CORP.
Detroit, Mich.
F. E. ANDERSON OIL CO.
Portland, Conn.
ANDERSON & SONS, INC.
Westfield, Mass.
R. B. ANNIS CO.
Indianapolis, Ind.
ANTON MACHINE WORKS
Brooklyn, N. Y.
THE APEX TOOL & CUTTER CO.
Shelton, Conn.
ARMSTRONG-BLUM MFG. CO.
Chicago, Ill.
ARMSTRONG BROS. TOOL CO.
Chicago, Ill.
THE ARO EQUIPMENT CORP.
Bryan, Ohio
E. C. ATKINS & CO.
Indianapolis, Ind.
ATLAS PRESS CO.
Kalamazoo, Mich.
AUSTENAL LABORATORIES, INC.
New York, N. Y.
AUTOMOTIVE INDUSTRIES
Chilton Company
Philadelphia, Penn.

W. O. BARNES CO., INC.
Detroit, Mich.
BAUSCH & LOMB OPTICAL CO.
Rochester, N. Y.
BAY STATE ABRASIVE PRODUCTS CO.
Westboro, Mass.
BEAVER TOOL & ENGINEERING CORP.
Royal Oak, Mich.
THE BELLOWS CO.
Akron, Ohio
BEMIS & CALL
Springfield, Mass.
BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.
Elyria, Ohio
BENZON MACHINE CO.
Lansdale, Pa.
BLACK DRILL CO.
Cleveland, Ohio
EDWARD BLAKE CO.
West Newton, Mass.
HENRY P. BOGGIS & CO.
Cleveland, Ohio
BOICE-CRANE CO.
Toledo, Ohio
BOKUM TOOL CO., INC.
Detroit, Mich.
BOYAR-SCHULTZ CORP.
Chicago, Ill.
THE BRAMSON PUBLISHING CO.
Detroit, Mich.
BRIDGEPORT MACHINES, INC.
Bridgeport, Conn.
THE BRINNELL CO.
Granby, Conn.
BROWN & SHARPE MANUFACTURING CO.
Providence, R. I.
CHARLES BRUNING CO., INC.
Chicago, Ill.
BRUSH DEVELOPMENT CO.
Cleveland, Ohio
BRYANT CHUCKING GRINDER CO.
Springfield, Vt.

CADILLAC GAGE CO.
Detroit, Mich.
CADILLAC STAMP CO.
Detroit, Mich.
CAMPBELL MACHINE DIV.
American Chain & Cable Co., Inc.
Bridgeport, Conn.
CARBOLOY COMPANY, INC.
Detroit, Mich.
CARBORUNDUM CO.
Niagara Falls, N. Y.
CHICAGO RIVET & MACHINE CO.
Bellwood, Ill.
CHROME ELECTRO-FORMING CO.
Detroit, Mich.
CIRCULAR TOOL CO., INC.
Providence, R. I.
CITIES SERVICE OIL CO.
New York, N. Y.
CLEVELAND INDUSTRIAL TOOL CORP.
Euclid, Ohio
CLINTON MACHINE CO.
Clinton, Mich.
COLONIAL BROACH CO.
Detroit, Mich.
COMMANDER MFG. CO.
Chicago, Ill.
CONOVER-MAST PUBLICATIONS, INC.
New York, N. Y.
COX ENGINEERING & SALES CO.
Detroit, Mich.
ARTHUR A. CRAFTS CO., INC.
Boston, Mass.
C. C. CRALEY MFG. CO.
Shillington, Penn.
F. M. CRAYTON CO.
Philadelphia, Penn.
CRYSTAL LAKE GRINDERS
Crystal Lake, Ill.
THE CUSHMAN CHUCK CO.
Hartford, Conn.
CYCLOID CORP.
Saugus, Mass.

DAKE ENGINE CO.
Grand Haven, Mich.
DANLY MACHINE SPECIALTIES, INC.
Chicago, Ill.
DCMT SALES CORP.
New York, N. Y.
O. F. DECASTRO & ASSOC.
Los Angeles, Calif.
DELAWARE TOOL STEEL CORP.
Wilmington, Del.
DENISON ENGINEERING CO.
Columbus, Ohio
DETROIT BROACH CO., INC.
Detroit, Mich.
DETROIT POWER SCREWDRIVER CO.
Detroit, Mich.
DETROIT STAMPING CO.
Finished Products Div.
Detroit, Mich.
DIAMOND DETROIT, INC.
Detroit, Mich.
H. E. DICKERMAN MFG. CO.
Springfield, Mass.
THE DOALL CO.
Des Plaines, Ill.
DONOVAN CO.
Philadelphia, Penn.
THE DUMORE CO.
Racine, Wis.

EASTMAN KODAK CO.
Industrial Optical Sales Div.
Rochester, N. Y.
EDGCOMB STEEL CO.
Philadelphia, Penn.
ELGIN NATIONAL WATCH CO.
Industrial Products Div.
Aurora, Ill.
ENCO MFG. CO.
Chicago, Ill.
ENGINEERS SPECIALTIES DIV.
Universal Engravers & Colorplate Co., Inc.
Buffalo, N. Y.
ENGIS EQUIPMENT CO.
Chicago, Ill.
ERICKSON STEEL CO.
Cleveland, Ohio
ERRINGTON MECHANICAL LAB., INC.
Staten Island, N. Y.
ETTCO TOOL CO., INC.
Brooklyn, N. Y.
EUGENE DIETZGEN CO., INC.
New York, N. Y.
EVEREDE TOOL CO.
Chicago, Ill.
EX-CELL-O CORP.
Detroit, Mich.

FALCON TOOL CO.
Detroit, Mich.
FEDERAL PRODUCTS CORP.
Providence, R. I.
FEN MACHINE CO.
Euclid, Ohio
FERGUSON MACHINE & TOOL CO., INC.
Ferguson, Mo.
FIDELITY TOOL SUPPLY
Camden, N. J.
FIRTH STERLING STEEL & CARBIDE CORP.
McKeesport, Penn.
FLOAT-LOCK CORP.
Bloomfield, N. J.
FLODAR CORP.
Cleveland, Ohio
FOSTER MFG. CO.
St. Louis, Mo.
FRICK GALLAGHER MFG. CO.
Wellston, Ohio

GAIRING TOOL CO.
Detroit, Mich.
GALE FORSSEN CO.
Springfield, Mass.
THE GAMMONS-HOAGLUND CO.
Manchester, Conn.
GARDNER PUBLICATIONS, INC.
Cincinnati, Ohio
GEROTOR MAY CORP.
Baltimore, Md.
GIDDINGS & LEWIS MACHINE TOOL CO.
Davis Boring Tool Div.
Fond du Lac, Wis.
L. H. GILMER DIV. OF U. S. RUBBER CO.
Philadelphia, Pa.
GODDARD & GODDARD CO.
Detroit, Mich.
THE GOVRO-NELSON CO.
Detroit, Mich.
GRAHAM-MINTEL INSTRUMENT CO.
Cleveland, Ohio
GRIFFITH-RAGUSE & CO., INC.
Philadelphia, Penn.
F. T. GRISWOLD MFG. CO.
Wayne, Penn.
GROBET FILE CO. OF AMERICA, INC.
New York, N. Y.
GULF OIL CO.
Pittsburgh, Pa.

HAMILTON MFG. CO.
Two Rivers, Wis.
HAMMOND MACHINERY BUILDERS INC.
Kalamazoo, Mich.
HANCHETT MAGNA LOCK CORP.
Big Rapids, Mich.
HANDY & HARMAN
New York, N. Y.
HANNA ENGINEERING WORKS
Chicago, Ill.
HANNAFIN CORP.
Chicago, Ill.
HARDINGE BROTHERS, INC.
Elmira, N. Y.
HAUSER MACHINE TOOL CORP.
Manhasset, N. Y.
HAYNES STELLITE CO.
New York, N. Y.
THE HEIM CO.
Fairfield, Conn.
HEINTZ MFG. CO.
Philadelphia, Pa.
THE HERMAN STONE CO.
Dayton, Ohio
HITCHCOCK PUBLISHING CO.
Wheaton, Ill.
THE E. HORTON & SON CO.
Windsor Locks, Conn.
HY-AIR PRODUCTS
Jackson, Mich.
HY-PRO TOOL CO.
New Bedford, Mass.

IDEAL INDUSTRIES, INC.
Sycamore, Ill.
ILLINOIS TOOL WORKS
Chicago, Ill.
INDEX MACHINE CO.
Jackson, Mich.
INDUSTRIAL DIAMOND ASSN. OF AMERICA, INC.
New York, N. Y.
THE INDUSTRIAL PRESS
Machinery Magazine
New York, N. Y.
INGERSOLL MILLING MACHINE CO.
Rockford, Ill.
INSTITUTE OF INDUSTRIAL LAUNDERERS, INC.
Chicago, Ill.
THE IRON AGE
New York, N. Y.

J & S TOOL CO., INC.
East Orange, N. J.
JACOBS MANUFACTURING CO.
Hartford, Conn.
JANNEY CYLINDER CO.
Holmesburg, Philadelphia, Penn.
CHARLES L. JARVIS CO.
Middletown, Conn.
JERGENS TOOL SPECIALTY CO.
Cleveland, Ohio
JOHNSON GAGE CO.
Bloomfield, Conn.
JONES & LAMSON MACHINE CO.
Springfield, Vt.

KALAMAZOO TANK & SILO CO.
Machine Tool Div.
Kalamazoo, Mich.
KAUFMAN MFG. CO.
Manitowoc, Wis.
KELLERFLEX PRATT & WHITNEY Div. Niles-Bement-Pond Co.
West Hartford, Conn.
KENNAMETAL, INC.
Latrobe, Penn.

LASSY TOOL CO.
Plainville, Conn.
LAST WORD SALES & ENGINEERING CO.
Royal Oak, Mich.
LATROBE ELECTRIC STEEL CO.
Latrobe, Penn.
K. O. LEE CO.
Aberdeen, S. D.

1950 TOOL ENGINEER'S INDUSTRIAL COST-CUTTING EXPOSITION

April 10–14, Convention Hall and Commercial Museum, Philadelphia, Pennsylvania

LINK-BELT CO.
Chicago, Ill.
LIPE-ROLLWAY CORP.
Syracuse, N. Y.
LIVINGSTONE ENGINEERING CO.
Worcester, Mass.
LOGAN ENGINEERING CO.
Chicago, Ill.
LOGANSPORT MACHINE CO., INC.
Logansport, Ind.
LOVEJOY TOOL CO., INC.
Springfield, Vt.
LUFKIN RULE CO.
Saginaw, Mich.
EDWARD A. LYNCH MACHINERY CO.
Wynnewood, Pa.

M B PRODUCTS CO.
Detroit, Mich.
MACKLIN CO.
Jackson, Mich.
MADISON MANUFACTURING CO.
Muskegon, Mich.
MAGNAFLUX CORP.
Chicago, Ill.
THE MARTINDALE ELECTRIC CO.
Lakewood, Cleveland, Ohio
MARVIN MACHINE PRODUCTS, INC.
Detroit, Mich.
THE METAL REMOVAL CO.
Chicago, Ill.
METAL WORKING, SUTTON PUB. CO.
New York, N. Y.
W. F. MEYERS CO.
Bedford, Ind.
MICHIGAN TOOL CO.
Detroit, Mich.
MICRO SWITCH
Div. of First Industrial Corp.
Freeport, Ill.
MILLER MOTOR CO.
Chicago, Ill.
A. MILNE & CO.
New York, N. Y.
MILTON EQUIPMENT CO.
Philadelphia, Penn.
MODERNAIR CORP.
Oakland, Calif.
MODERN INDUSTRIAL ENGINEERING CO.
Detroit, Mich.
MONTGOMERY & CO., INC.
New York, N. Y.
MOORE PRODUCTS CO.
Philadelphia, Penn.
MOORE SPECIAL TOOL CO., INC.
Bridgeport, Conn.
MORTON MACHINE WORKS
Ferndale, Mich.
McCASKEY REGISTER CO.
Industrial Div.
Alliance, Ohio
McGRAW-HILL PUBLISHING CO., INC.
American Machinist
New York, N. Y.
MUELLER ENGINEERING CO.
Dearborn, Mich.

NATIONAL BROACH & MACHINE CO.
Detroit, Mich.
NATIONAL JET CO.
Cumberland, Md.
NATIONAL MACHINERY EXCHANGE
New York, N. Y.
NATIONAL TOOL CO.
Cleveland, Ohio
NATIONAL TOOL SALVAGE CO.
Detroit, Mich.
NELCO TOOL CO., INC.
Manchester, Conn.
NEW HERMES ENGRAVING & MACHINE CORP.
New York, N. Y.
NICHOLS-MORRIS CORP.
New York, N. Y.
NILSSON GAGE CO., INC.
Poughkeepsie, N. Y.

C. A. NORGREN CO.
Denver, Colo.
NORTON CO.
Worcester, Mass.

THE OHIO CRANKSHAFT CO.
Tocco Division
Cleveland, Ohio
THE O. K. TOOL CO.
Div. of Williams & Hussey Machine Co.
Shelton, Conn.
OAKITE PRODUCTS, INC.
New York, N. Y.
O'NEIL-IRWIN MFG. CO.
Lake City, Minn.
ORTMAN-MILLER MACHINE CO., INC.
Hammond, Ind.
OZALID
Div. of General Aniline and Film Corp.
Johnson City, N. Y.

PANGBORN CORP.
Hagerstown, Md.
PEDRICK TOOL & MACHINE CO.
Philadelphia, Penn.
PENTON PUBLISHING CO.
Cleveland, Ohio
PHYSICISTS RESEARCH CO.
Ann Arbor, Mich.
PINES ENGINEERING CO., INC.
Aurora, Ill.
PIONEER PUMP & MFG. CO.
Detroit, Mich.
PORTER MACHINE CO., DIV.
Cincinnati, Ohio
PORTER PRECISION PRODUCTS
Cincinnati, Ohio
THE FREDERICK POST CO.
Chicago, Ill.
HORACE T. POTTS
Philadelphia, Penn.
PRATT & WHITNEY
Div. Niles-Bement-Pond Co.
West Hartford, Conn.
PRECISE PRODUCTS CO.
Racine, Wis.
PRECISION DETROIT CO.
Detroit, Mich.
PRECISION GRINDING WHEEL CO., INC.
Philadelphia, Penn.
PROCUNIER SAFETY CHUCK CO.
Chicago, Ill.
PRODUCTION MACHINE CO.
Greenfield, Mass.
THE PRODUCTO MACHINE CO.
Bridgeport, Conn.
PUTNAM TOOL CO.
Detroit, Mich.

RACINE TOOL & MACHINE CO.
Racine, Wis.
READY TOOL CO.
Bridgeport, Conn.
RAHN GRANITE SURFACE PLATE CO.
Dayton, Ohio
REPUBLIC GAGE CO.
Detroit, Mich.
RIVETT LATHE & GRINDER, INC.
Brighton, Mass.
ROCKWELL MFG. CO.
Power Tool Div.
Milwaukee, Wis.
ROSS OPERATING VALVE CO.
Detroit, Mich.
H. B. ROUSE & CO.
Chicago, Ill.
ROYAL OAK TOOL & MACHINE CO.
Royal Oak, Mich.
RUDEL MACHINERY CO.
New York, N. Y.
RUSSELL, HOLBROOK & HENDERSON, INC.
New York, N. Y.
JOSEPH T. RYERSON & SON, INC.
Chicago, Ill.

SALES SERVICE MACHINE TOOL CO.
St. Paul, Minn.
SCHAUER MFG. CORP.
Cincinnati, Ohio
GEORGE SCHERR CO., INC.
New York, N. Y.
A. SCHRADER'S SON
Brooklyn, N. Y.
SCHRAMM, INC.
West Chester, Pa.
SCULLY-JONES & CO.
Chicago, Ill.
SEIBERT & SONS, INC.
East Peoria, Ill.
SERVICE MACHINE CO.
Chicago, Ill.
SEVERANCE TOOL INDUSTRIES, INC.
Saginaw, Mich.
SHEFFER COLLETT CO.
Traverse City, Mich.
SHEFFIELD CORP.
Dayton, Ohio
SHELDON MACHINE CO., INC.
Chicago, Ill.
SHELL OIL COMPANY, INC.
New York, N. Y.
SIEWEK TOOL CO.
Detroit, Mich.
SIMONDS SAW AND STEEL CO.
Simonds Abrasive Co.
Fitchburg, Mass.
SIMPSON ELECTRIC CO.
Chicago, Ill.
SIZE CONTROL CO.
Chicago, Ill.
SOCONY VACUUM OIL
New York, N. Y.
SOUTH BEND LATHE WORKS
South Bend, Ind.
SPERRY PRODUCTS, INC.
Danbury, Conn.
STANDARD DIE SET MFRS., INC.
Cranston, R. I.
STANDARD ELECTRICAL TOOL CO.
Cincinnati, Ohio
STANDARD GAGE CO., INC.
Poughkeepsie, N. Y.
STANDARD PRESSED STEEL CO.
Jenkintown, Penn.
STANDARD SHOP EQUIPMENT CO.
Philadelphia, Penn.
THE STAPLES TOOL CO.
Cincinnati, Ohio
L. S. STARRETT CO.
Athol, Mass.
STEEL PRODUCTS ENGINEERING CO.
Springfield, Ohio
EDWIN B. STIMSON CO., INC.
Brooklyn, N. Y.
STOKERUNIT CORP.
Milwaukee, Wis.
STONE MACHINERY CO., INC.
Manlius, N. Y.
D. A. STUART OIL CO., LTD.
Chicago, Ill.
SUN OIL CO.
Philadelphia, Penn.
SUNDSTRAND MACHINE TOOL CO.
Hydraulics Division
Pneumatic Products
Rockford, Ill.
SUNDSTRAND MAGNETIC PRODUCTS CO.
Rockford, Ill.
SUNNEN PRODUCTS CO.
St. Louis, Mo.
SUPER TOOL CO.
Detroit, Mich.
SYNTRON CO.
Homer City, Penn.

TAFT-PEIRCE MFG. CO.
Woonsocket, R. I.
TAYLOR DYNAMOMETER & MACHINE CO.
Milwaukee, Wis.
THE TEXAS CO.
Industrial Sales Training
New York, N. Y.
TIDE WATER ASSOCIATED OIL CO., INC.
New York, N. Y.
TINIUS OLSEN TESTING MACHINE CO.
Willow Grove, Penn.
TODD CO., INC.
Rochester, N. Y.
THE TOMKINS-JOHNSON CO.
Jackson, Mich.
TOOL & DIE JOURNAL
Cleveland, Ohio
TRABON ENGINEERING CORP.
Cleveland, Ohio
TUBULAR MICROMETER CO.
St. James, Minn.
TWENTIETH CENTURY MFG. CO.
Chicago, Ill.

UNION MANUFACTURING CO.
New Britain, Conn.
U. S. DEPT. OF COMMERCE
Philadelphia, Pa.
UNIVERSAL VISE & TOOL CO.
Parma, Mich.
UNIVERTICAL MACHINE CO.
Royal Oak, Mich.
URBAUER ENGINEERING CO.
Freeport, Ill.

THE V & O PRESS CO.
Hudson, N. Y.
VANADIUM-ALLOYS STEEL CO.
Latrobe, Penn.
VAN KEUREN CO.
Watertown, Mass.
VAPOR BLAST MFG. CO.
Milwaukee, Wis.
VERSA MILL CO.
New York, N. Y.
VIBRO MODULATOR MOUNTS
Philadelphia, Penn.
VICKERS, INC.
Detroit, Mich.
THE VIKING TOOL CO.
Shelton, Conn.
VLIER MFG. CO.
Los Angeles, Calif.
THE VULCAN TOOL CO.
Dayton, Ohio

WALDES-KOHINOOR, INC.
Long Island City, N. Y.
WALES-STRIPPIT CORP.
N. Tonawanda, N. Y.
WALKER-TURNER
Div. Kearney & Trecker Corp.
Plainfield, N. J.
WALSH PRESS & DIE CO.
Chicago, Ill.
WATSON-FLAGG MACHINE CO., INC.
Paterson, N. J.
THE WEATHERHEAD CO.
Cleveland, Ohio
WEBBER GAGE CO.
Cleveland, Ohio
WESSON CO.
Ferndale, Mich.
WESTERN TOOL & MFG. CO.
Springfield, Ohio
WEST POINT MFG. CO.
Farmington, Mich.
S. B. WHISTLER & SONS, INC.
Buffalo, N. Y.
THE WICKMAN MFG. CO.
Detroit, Mich.
WILSON MECHANICAL INSTRUMENT CO., INC.
Associate of American Chain and Cable Co., Inc.
New York, N. Y.
WILTON TOOL MFG. CO.
Chicago, Ill.
N. A. WOODWORTH CO.
Detroit, Mich.

ZAGAR TOOL, INC.
Euclid, Ohio

(Continued from Page 57)

Housings are cast, machined to close limits, and multiple-drilled, using a precision jig. A tooth-generating operation is performed on the wheel disc, wheel faces are hardened and polished and shafts splined, before assembly, inspection, and run-in under load. One unit has a variable-speed drive utilizing a laminated chain between two conical discs, forming its own tooth from one pair of discs to the other.

You'll see containers for your beer and motor oil coming off the lines at Crown Can Co. Sheets of tinplate are first lithographed with the customer's design, then baked. After emerging from the ovens, the sheets are cut into can end and body stock.

An automatic high-speed machine forms bodies and solders the side seam. Other machines flange the ends of the cylinder and double-seam the bottom.

Observers will admire the complex automatic equipment and rapid conveyor system essential to low cost production in this industry.

To See Television Set Production

Across the Delaware River at Camden, N. J., Radio Corp. of America will welcome conventioners to the Little Theatre of the RCA Victor Division. A company representative will demonstrate auditorium-type, large-screen television equipment and the 45-rpm system of music reproduction.

After a guided tour of the showroom the delegates will inspect the television receiver production lines.

Tool engineers will feel right at home in the experimental laboratories of Philco Corp. where other engineers are bucking problems in constructing models of next year's refrigerators, freezers, air conditioners, radio and television sets.

The Philco visit will include mass production operations in the factory.

Amid all the show and convention activity, plans will be going forward for future Society events.

Wednesday, during the annual meeting of the Board of Directors at the Benjamin Franklin Hotel, 1950-51 national officers will be elected. The House of Delegates will hold a caucus the same day and will meet again Thursday to elect directors.

National Officers to Be Installed

That evening the new national officers will be installed at the annual banquet and membership meeting in the Bellevue-Stratford Hotel ballroom. A nationally-known figure in industry will address the dinner audience. Professional entertainment, and dancing will conclude the program.

Jay N. Edmondson of Ohio State University, national education chairman, is calling a meeting of his committee, Tuesday, at the Benjamin Franklin. Other national committees also expect to confer during the convention.

* * *

You'll need an extra day or two to get around and see some of the sights of the nation's founding place.

Walking through the ancient buildings in Independence Square, you'll feel a new appreciation of the freedom we accept so casually. Stop first at Independence Hall, dominated by the great bronze bell that proclaimed liberty for all. Over here is the room where the Declaration of Independence and the Constitution were signed; there, the Judicial Chamber used by the Supreme Court of the Province of Pennsylvania, and the Banquet Hall where the Treaty of Peace between the United States and Great Britain was celebrated.

Nearby Congress Hall was once the capitol of the young country. Across the Square towers a modern publishing house, home of the first magazine in America.

Look for Carpenters' Hall

Slow down as you come along Chestnut Street or you'll miss Carpenters' Hall. Now drowsing unobtrusively in a little courtyard, the venerable building once reverberated with Patrick Henry's pleas to the First Continental Congress to throw off a tyrant's yoke.

Turn in at the narrow, flag-hung house on Arch Street. It's where Washington called and commissioned Betsy Ross to make the newly-designed national emblem.

If you step out of Second Street traffic, you can be carried back 250 years into quiet Elfreth's Alley, oldest existing street of its period.

Push buttons in Franklin Institute to see the wonders of modern science performed before you. Mount the tower platform on City Hall for a pigeon's eye view of the third largest city. Admire the broad boulevard stretching away from it through the cultural center.

Or ride down to the foot of Broad Street where Navy Yard workers are busy repairing and overhauling air, surface and undersea fighting craft.

But there are hundreds of other things to see. To line up your own itinerary, ask the Philadelphia Transportation Co., 1405 Locust St., Philadelphia 2, Pa., to send you a copy of their visitors' book.

And watch for the big April *Tool Engineer*. It's coming out a week early to bring you the full exposition guide and convention program.

d'Arcambal Appointed General Sales Manager

Hartford, Conn.—A. H. d'Arcambal, vice-president and sales manager, small tools and gages, and consulting metallurgist, has been appointed general sales manager, Niles-Bement-Pond Co.

A former ASTE president, Mr. d'Arcambal recently celebrated his 30th anniversary with his company. In his new capacity he will head all sales departments. Among sales managers on his staff are Harry Reichert, manager, Pratt & Whitney foreign sales, of Hartford chapter, ASTE, and J. P. Cunningham, vice-president-sales manager, Potter & Johnston Co., a Little Rhody member.

Mr. d'Arcambal's appointment was made on the retirement of W. P. Kirk, vice-president and sales manager, machine tools, from active participation in the firm's sales program.

Are You Losing Money?

Folks all around you are losing thousands of dollars every day in Social Security benefits. How about you? Your friends and your relatives?

And how is this money lost? Simply by not filing your application for benefits on time—or by not filing it at all. Some people fail to file because they don't know they should. Others fail to file because they think they aren't entitled to the benefits, often because they have been misinformed.

Social Security officials estimate that, of every six people entitled to benefits, one will lose as much as $100. Many lose more. And it isn't only the older people who lose out. Failure to file a claim immediately upon a worker's death has meant losses to many younger widows and their children.

Your Social Security office is as near to you as your telephone. Free pamphlets are available and so are post cards which you can use to check your own social security record.

If you have any questions, call your Social Security office.

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Chapter listings include member as well as meeting news.

Six Additional Directoral Candidates Nominated by Petition

Detroit, Mich.—Exercising their prerogative to form special nominating committees, members of several chapters have petitioned the nomination of six candidates for Society directors. These are in addition to the 17 previously chosen by the Annual Nominating Committee, headed by I. F. Holland of Hartford, Conn.

All 23 candidates will be listed on the official ballot for election of directors at the House of Delegates, April 13, during the 18th annual meeting in Philadelphia.

B. J. Hazewinkel

H. E. Linsley

F. J. Schmitt

H. L. Horton

Names and qualifications of the supplementary nominees follow:

Thomas J. Donovan, Jr.—Owner, Donovan Co., Philadelphia, Pa. One of three organizers of Philadelphia chapter and active in all chapter affairs since. Senior member since 1938; charter member and past chairman, Philadelphia chapter. Former member, National Constitution and By-Laws Committee and incumbent national director (third term). Active member, Philadelphia chapter, ASM. Life member, Army Ordnance Association and Franklin Institute. Broad industrial and executive experience. Active in other technical organizations.

George A. Exley—Chief, experimental engineering section, Bendix Radio Div., Bendix Aviation Corp., Towson, Md. Senior member since 1942. Has actively served in various capacities in the Boston and Baltimore chapters. Member, National Membership Committee (three years). Member, Annual Nominating Committee, 1950. Member, Institute of Radio Engineers. Wide industrial and executive experience. Graduate electrical and mechanical engineer.

* * *

Ben J. Hazewinkel—Representative of L. S. Starrett Co., Denver, Colo. Senior member since 1942. Responsible for organization of Denver chapter; served as chapter chairman and delegate. Incumbent member, National Membership Committee. Active in local civic and technical organizations. Broad industrial background in tool engineering field.

T. J. Donovan, Jr.

G. A. Exley

Holbrook L. Horton—Editor, Machinery's Handbook, and manager of book publishing, The Industrial Press, New York City. Senior member since 1940. Active in numerous chapter capacities culminating in chairmanship of Greater New York chapter, 1946-47. Chapter representative on Technical Societies Council of New York. Holds B.S. in Electrical Engineering. Experienced as executive and in technical magazine and book editing.

* * *

Horace E. Linsley—Associate editor, *American Machinist*, New York City. Senior member since 1941. Active in Northern New Jersey chapter; chairman, 1943. Member, National Program Committee, 1945-46. Early industrial experience obtained in England and France, followed by several years as tool designer at Buffalo, N. Y., prior to entering public relations work and technical writing. Active in other technical and civic organizations.

* * *

Fred J. Schmitt—Director of sales, D. A. Stuart Oil Co., Chicago, Ill. Senior member since 1938. Has served in various chapter capacities culminating in chairmanship, Chicago chapter 1947-48. Member, National Program Committee five years, now chairman. Chairman, 1948 House of Delegates; active in other technical and executive organizations. Has B.S. in Chemical Engineering; experienced in technical and executive positions.

Die Hobbing Expedites Plastic Mold Making

Galt, Ont.—A means of reducing costs and doing difficult molding jobs through "Hobbing of Dies for Plastic Molds and Dies" was presented recently to Grand River Valley engineers.

Speaking on this subject before the January 6 chapter meeting at Legion Hall, John A. Martin first dealt with blanking and forming dies, then outlined engineering procedures for designing and setting up dies for quantity and quality production, and costs involved.

The engineers were especially interested in his description of small, multiple operation dies and the precision setup and operation required.

Another highlight concerned Mr. Martin's comments on injection and compression molding of plastic parts, intricate and otherwise.

Harry H. Whitehall, chairman, introduced chapter officers and speakers' table guests. Samuel Moffat, factory manager of Canada Machinery Corp., presented the technical speaker.

Ninety members and guests were present for the meeting and subsequent buffet lunch, served by wives of the chapter officers.

How Many, Please?

Remember how the 1944 annual banquet at Philadelphia broke ASTE attendance records? This year the host chapter is trying to outdo itself in local representation.

To be sure of having a place at this important national function, order your tickets now. Fill in the form at the right and mail it with your remittance today.

Banquet Committee
American Society of Tool Engineers
17th and Sansom Streets
Philadelphia 3, Pa. ....., 1950

Please reserve ..... tickets, at $7.00 each, for the ASTE Annual Banquet to be held at 7:00 p.m., Thursday, April 13, at the Bellevue-Stratford Hotel, Philadelphia, Pa.

☐ Please send me an advance registration blank for the ASTE Exposition at Convention Hall, Philadelphia, April 10-14.

☐ I need a hotel reservation form.

.....
(Name)

Payment in the amount of

$..... is enclosed. .....
(Address)

.....

NOTE- Make check payable to the American Society of Tool Engineers. Do not send currency.

Prominent at Racine chapter's recent hydraulics meeting were, standing at speakers' table, from left: Jerome B. Anderson of Racine Tool & Machine Co., George B. Miller, technical speaker, from the same firm; George W. Christiansen, chapter chairman; George Tigges, vice-chairman; and Robert Schultz, program chairman.

Packaging Machine Firm Uses Special Techniques

New York City—Strides made in the past 50 years in developing machinery for manufacturing and packaging consumer goods were graphically demonstrated to Greater New York chapter when C. W. Johnson, assistant general manager of American Machine & Foundry Co., presented a slide lecture January 3 before more than 250 members of that group.

In succession Mr. Johnson showed early types of cigar filling machines and present models. Each manufacturer's machines must be built to maintain his particular shape of cigar, length of taper at ends, and overall length.

Similar machines for the cigarette industry, operating at high speed, completely package the product, even to affixing the revenue stamp.

Automatic Food Processing

The smoothly wrapped loaf of bread from the baker comes off another of these automatic machines, with the sliced loaf controlling the size of the wrapping. "Pretzel benders" involve a whole series of machines which drop the pretzel on a conveyor.

Through advancements in necktie making machinery, your haberdashery no longer falls apart if one stitch comes loose.

Since such machines require special cams, Mr. Johnson's firm had to devise their own method of milling, grinding and otherwise processing cams.

Necessity also produced the Wahlstrom drill chuck and tapping attachment. With two chuck models, practically the entire range of sizes can be handled. An operator can quickly change sizes of drills, reamers, and counterbores while the spindle is running. The same flexibility is possible with the tapping attachments.

The speaker showed taps for threading a series of nuts, each being elevated one above the other along the long shank and later removed together.

Additional slides showed operations on machines adopted for this company's particular method of manufacturing.

The final illustrations revealed the processing of cigar fillers, binders and wrappers and the manufacture, packing and inspection of the product.

Among out-of-town guests were Joseph L. Petz, Mid-Hudson chapter chairman, and a delegation from his chapter. After the meeting refreshments were served.

Demonstrates Hydraulics For Deep Drawing

Racine, Wis.—Approximately 100 members and guests from Racine, Kenosha and Milwaukee gathered January 10 at the Racine Manufacturers Building to learn about hydraulic equipment and its uses.

George B. Miller, chief engineer, Hydraulic Div., Racine Tool & Machine Co., was the speaker at the Racine chapter dinner meeting. Mr. Miller outlined types of oil hydraulic equipment available to industry and advantages and drawbacks to consider when selecting such equipment as a power supply.

His talk was highlighted by a film furnished by the Lauton Manufacturing Co., Depere, Wis., showing a Lautomatic press equipped with hydraulic equipment in operation at the V. W. Danielson Co. in Milwaukee. The smoothness of hydraulic power during deep drawing operations was clearly illustrated.

A Shell Oil film on basic hydraulics, "Harnessing Liquids," preceded the technical discussion.

Heat Treat Know-How Pays Off in Dollars

Indianapolis, Ind.—The 1950 program of Indianapolis chapter got off to a good start with 90 members and guests attending the January 5 meeting at The Athenaeum.

Combining humor with engineering information, the technical session was easy to take. T. J. Donovan, Jr., ASTE national director from Philadelphia, put on his well-known "Silver Dollar Quiz."

"Cartwheels" and 50-cent pieces were passed out liberally by "Professor I. Q." Donovan, according to the degree of accuracy of answers to his questions on heat treating and other tool engineering subjects.

Three new members were welcomed during the meeting. Through intensive efforts to win recruits, the chapter hopes to introduce larger groups.

Our Society

By Harry E. Conrad, Executive Sec'y

If there ever is a month that will have 60 days in it, I would vote for February —especially in the years that we have an exposition. Between all the last-minute services so necessary for our exhibitors, there is an officers' meeting to prepare for, a mailing to the entire membership and all the countless details of the convention proper.

My fear is that, in all the hustle, some minor detail will be overlooked, giving someone an opportunity to "blow his top." I've never been able to figure out why, but it always happens. A mountain can be moved without notice but just let someone slip on a pebble and you have a lawsuit on your hands.

The foregoing must have been provoked by the fact that I have an appointment with an insurance agent to provide coverage for the Exposition and Convention.

Membership interest continues at a high level and will accelerate as Exposition and Convention publicity becomes more intensified. It's a good time for Chapter Membership Committees to take advantage of the ASTE-permeated atmosphere and sign up new members.

Economists, Recognize Profession

The Economics Forum, scheduled at the Academy of Music in Philadelphia Monday evening, April 10, is not only an all-star attraction in itself but it heralds another advanced approach to the Society's struggle for professional recognition.

The names of the men participating —Nourse, Livingston, Balderston and Cheyfitz rate tops in their field. They know the position the tool engineer holds in our American Way of Life and the utmost necessity of maintaining a free enterprise system. It is the only system wherein the tool engineer is free to develop and progress himself as he advances his employer's business. Its importance to World Economy is a challenge to good tool engineering.

I hope you'll make the convention. We're expecting you. You'll be proud of the ASTE booth!

Aids Louisville Members With Air Brake Problems

Louisville, Ky.—E. B. Rhodes, industrial sales engineer for the Bendix-Westinghouse Automotive Air Brake Co., addressed approximately 60 engineers, January 11, at a dinner meeting of Louisville chapter. His subject was "Robotair in Industrial Use."

A film showing the operation and application of the Westinghouse air brake in the truck industry was followed by slides illustrating industrial uses.

Well versed in these fields of air applications, Mr. Rhodes held the close attention of his audience throughout the program. In a subsequent question and answer session, he assisted members in their individual problems.

A guest at the Springfield (Mass.) chapter's first ladies night asks Mrs. Gladys Babson Hannaford (left) a question about diamonds. Mrs. Hannaford, a noted lecturer on this subject, was featured speaker at the January social event.

Cost Estimating Vital Tool in Meeting Competition

Chicago, Ill.—Accurate cost esimating is vital to business survival, Harry Conn, chief engineer of Scully-Jones & Co., emphasized in a lecture to 75 members and guests of the student ASTE section at the Allied School of Mechanical Trades.

Guest speaker at the January 24 meeting of the group, Mr. Conn pointed out that if costs are estimated too high they will invite ruinous competition; if too low, bankruptcy threatens.

Disregards Human Element

A good estimator, he believes, can figure the time required for an operation more accurately than a time study man. An estimator does not deal with the human element. A time study expert may time an operator who is slow or fast. Or a normal operator may not be feeling up to par the morning the time study is made. Such studies, Mr. Conn commented, should be made before production begins.

In compiling cost figures an estimator considers the number of pieces to be run, type of material to be processed, operations to be performed, cost of purchased parts and of tooling.

When considering the number of pieces to be made, an estimator determines whether the part will be made from bar stock, a sand casting, permanent mold casting, or die casting.

Evaluates Methods

He ponders the manufacturing method which will give the lowest cost for the quantity required. If the run is too short, the jigs and fixtures will not save enough money to justify their cost. Through extra operations and higher scrap, close tolerances send costs up appreciably.

Type of material influences machining time. Aluminum, for instance, can be machined much faster than stainless steel for the same operations and amount of stock removal.

As concrete examples of calculations on speeds and feeds, Mr. Conn showed books and figures used by his company in estimating costs. After the sequence of operations and time required to make a part are determined, a departmental rate is applied to each operation to obtain the cost. A markup is added to all purchased items to offset the discount to distributors on the finished product.

In a lively discussion following Mr. Conn's talk, the relative merits of incentive systems were threshed out. Throughout his remarks Mr. Conn pounded home the fact that the American Way of Life is to make things as good and as cheap as possible or be forced out of business by competition.

Before the technical session Richard Lingen, student chairman, conducted an election of officers. Stanley Jaskawicz was elected vice-chairman and Edward Mechlas, secretary.

Three Technical Groups Hear Welding Educator

St. Louis, Mo.—St. Louis chapter met January 5 with members of the American Welding Society and the Engineers Club. Dinner at the Camille Tearoom preceded a business meeting and technical program at the Engineers Club. Despite a freezing rain and ice-covered roads, 135 members of the three organizations were present.

Guest speaker was Robert S. Green, acting chairman, department of welding engineering, Ohio State University. His talk concerned reasons for establishing a curriculum in welding engineering. He also discussed research projects and equipment, as well as plans and accomplishments in the field of tool engineering.

Young men planning a welding career, he advised, should have four years of mechanical engineering with an extra year devoted to the study of welding, chemistry and metallurgy.

Mr. Green, who has had extensive experience with some of the country's largest industrial organizations, is consultant to the National Certified Pipe Welding Bureau and has served as editor for *Design for Welding*, published by the James F. Lincoln Arc Welding Foundation of Cleveland, Ohio.

Markey Talks on Jets

Milwaukee, Wis.—"Jet Engines and Jet Propulsion" was the subject discussed by Howard T. Markey, engineer, air expert, and pioneer test pilot of jet powered planes, at a recent meeting of Milwaukee chapter.

Mr. Markey's talk included discussion of ram and turbo jet engines, rockets, and a proposed rocket flight to the moon. The speaker concluded his presentation with a film on jet planes.

Walter Behrend, a chapter member, spoke on his recent trip to the Continent. He showed a European travel film produced by American Air Lines.

Diamond Authority Shows Gems at Ladies Night

Springfield, Mass. — Diamonds that have made history were shown in replica and narrated to 123 Springfield women and their escorts, attending the ASTE chapter's first annual ladies night, held January 9 at Rovelli's Restaurant.

Mrs. Gladys Babson Hannaford, a noted lecturer on diamonds, addressed the group, displaying models of the great gems of diamond history.

Having recently visited South African mines, Mrs. Hannaford was able to detail the processing of these precious stones after they are brought to the surface.

A portion of Mrs. Hannaford's lecture was illustrated by projected pictures of mines, including some remarkable views of miners at work. Rarely, but often enough to attract many to this difficult field, a miner makes a spectacular find. He turns it over to the mining company, claiming a bonus for his unusual accomplishment.

In the role of toastmaster, C. B. Dick, manager of the East Springfield plant of Westinghouse Electric Corp., spiced his formal introductions with quips about the chapter officers.

Explains How Processing Changes Metal Structure

New Haven, Conn.—Approximately 75 members and guests of New Haven chapter heard E. V. Crane, chief engineer of The Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio, lecture recently on "Metal Working Principles Underlying Punch and Die Design and Automatic Presses."

Mr. Crane, technical speaker at the January 12 meeting at Fitzgerald's Restaurant, used slide illustrations in discussing metal rolling, deep drawing, stretching, bending, extrusion, forging and blanking.

With charts and graphs the speaker explained changes occurring in most common metals during these methods of fabrication. A question period followed his talk.

During a business meeting the following Nominating Committee was elected: Alton Pollard, chairman, Ralph Clarkson and John Diefenbach.

Tells How to Control Vibration, Heat While Cutting

Montreal, Que.—January 12 meeting of Montreal chapter in Canadian Legion Hall was highlighted by a discussion, "Metal Cutting," by W. N. Bennett, Eastern sales manager for Racine Tool & Machine Co., Racine, Wis.

Mr. Bennett first showed motion pictures of hacksawing. Part of the film, in slow motion, demonstrated cutting action, chip formation and how correct speed and moderate feeds increase blade life. Other sequences showed that thickness and hardness of stock govern the number of teeth used in the saw blade.

"The cutoff is one of the most important and least talked about metal cutting operations," said Mr. Bennett as he went on to explain correct methods of using saws and abrasive wheels to an interested audience of more than 100 members and guests.

"Vibration and heat are the two factors governing success of every metal cutting operation," the speaker stated. Vibration, he showed, can be controlled by correct tension in the blade and frictional heat can be overcome by proper cutting angles and coolants.

Adjust Guides After Centering Saw

In bandsawing, Mr. Bennett continued, setting the guides is most important. The saw should be allowed to center itself, before the guides are adjusted. Uneconomical on bar stock, bandsaws should be used only on work of thin section.

The circular type of segmented saw can be used at higher speeds and feeds than the solid type. But its application should be studied from the cost angle, Mr. Bennett advised.

Abrasive cut-off wheels, he commented, are limited to hard materials up to diameters of 2½ in.

The best cutting oils, he believes, are of the soluble type, usually a mixture of lard oil, mineral oil and sulphurized oils.

The speaker was introduced by M. A. Cote and thanked by G. S. Clarke.

Through the courtesy of Upton Bradeen and James Co. and the Simonds Canada Saw Co., refreshments were served after the meeting.

Petroleum Industry Seeks Constant Viscosity Oil

Chicago, Ill.—Lubricating oils that solidified at 60 deg below zero stalled the mechanized German army in Russia, Dr. Gustav Egloff, director of research, Universal Oil Products Co., told Chicago chapter while emphasizing the importance of lubricants in every field of activity.

Speaking on "Oils for Industry" before 175 members and guests attending a meeting, January 10, at the Western Society of Engineers, Dr. Egloff added that lubricants have been developed to function in temperatures ranging from desert heat to high altitude cold.

An oil with constant viscosity at extreme temperature variation is one of the goals of the oil industry's huge research program. The speaker also explained how desired qualities are obtained in petroleum products.

Harry Procunier, president, Procunier Safety Chuck Co. and a chapter member, followed Dr. Egloff with a lecture on the Alcan Highway and Alaska.

The accompanying color film showed difficulties encountered in constructing this highway and the rugged terrain along the route.

Sequences included the oil refinery at White Horse, formerly operated by the U. S. government, gold mining at Juneau, Eskimo life, fishing and other activities. Anton Schwister, chairman, introduced the speakers. Harry Egan, membership chairman, spoke on advantages of Society membership.

Frank Martindell, Mr. Egan and Mr. Schwister were elected a nominating committee to draw up a slate of chapter officer candidates.

Left: Harry Procunier (with cigarette) tells Percy Pearson an anecdote about his Alcan Highway trip, after lecturing on this subject before the Chicago chapter. Right: Chairman Anton J. Schwister (left), talks over lubricants with the technical speaker, Dr. Gustav Egloff of Universal Oil Products Co.

Situations Wanted

CARBIDE COORDINATOR—toolmaker, engineer; background of 15 years in tool manufacturing, wear parts and dies; past seven years in carbides. Present record as carbide coordinator for large tool manufacturer shows substantial savings in operating costs. Have worked as machinist, grinder, toolmaker, foreman, carbide engineer, owner of business. Cost-conscious, efficient organizer, experienced in every phase of carbide.

Age 35, family, locate anywhere, detailed resume available. Box 205, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

DESIGN ENGINEER—42, with 20 years of engineering experience, including design of jigs, fixtures, dies, machines and agricultural equipment. Several years in aircraft tooling. Box 200, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

GRADUATE INDUSTRIAL ENGINEER—32, experienced time and motion study, installing and setting wage incentives and labor standards, work simplification, methods improvement, plant layout, job evaluation, and establishing standards from standard data for tool and die machine shop jobs. Unmarried, prefers employment in California. Box 201, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

SALES ENGINEER—District representative for special machines and tools for Michigan industry. Wide experience in grinding and honing; well acquainted in auto industry. Fifteen years' experience.. Can furnish excellent references. Reply to Box 204, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Michigan.

SALES ENGINEERING-MANAGEMENT—Graduate mechanical engineer with management and marketing training; four years as sales and engineering representative; two years of manufacturing and shop experience. Member ASTE and ASME; ex-naval officer, age 31, prefers West or South. Box 203, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

TOOL ENGINEER—extensively experienced in manufacturing, production, inspection, and control engineering in firearms, automotive, and blank book industries. Box 206, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

TOOL ENGINEER—with 10 years' experience, past two and one-half years as assistant chief tool engineer. Have demonstrated ability as coordinator and producer. Familiar with stampings, machinery, metal finishing, screw machine work and assembly processes in the manufacture of valves, home appliances, vending machines, aircraft and gaging equipment. Resume available on request. Box 202, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

This dinner group turned out for Hartford chapter's program on clockmaking. From left: Harry Hauck, a past chairman; Ray Morris, a former chairman and Society president; George Thomas, Gisholt Co. representative; George Highberg and Henry Rockwell, also past chairmen; R. H. Kleinschmidt, salesman for Ray Morris Co.; and Joseph Balciunas, a former chapter committee chairman.

Clock Production Expert Contrasts Old, New Methods

Hartford, Conn.—Tool engineering in the clock industry highlighted one of the most interesting programs of the current season for Hartford chapter members who attended the January 10 technical meeting at the City Gas Co. auditorium.

M. H. Kaefer, works manager for a clock manufacturer, opened his talk by relating the history of clock making and processes formerly used. In contrast, he outlined modern production operations now employed in the industry, described practical dies and tools and evaluated methods and tools. Educated in horology in Germany, Mr. Kaefer has devoted his life to the clock industry.

Dinner at the Bond Hotel preceded the meeting. As coffee speaker the Connecticut highway commissioner talked straight from the shoulder on needed road construction and related financing.

Technical chairman for the meeting was Herbert F. Jahn, president of B. Jahn Mfg. Co., New Britain. A chapter member, Mr. Jahn is first vice-president of the National Tool and Die Association.

* * *

On December 5 the chapter joined with the Hartford Society for Measurement and Control, Constituent Section of ASQC in presenting an eight-man panel on Quality Control.

The speakers were: Dorian Shainin, chief inspector, and T. W. Read, statistician salvage engineer, Hamilton Standard Div., United Aircraft Corp., East Hartford; William Wilson, chief inspector, Fuller Brush Co., Hartford; D. E. Taylor, supervisor of manufacturing quality control, Pratt & Whitney Aircraft Div., United Aircraft Corp., East Hartford.

J. A. Spring, foreman, heavy duty parts, New Britain Gridley Div., New Britain Machine Co., New Britain; P. M. McDonald, quality control engineer, Whitney Manufacturing Div., Whitney Hanson Industries, Hartford.

A. G. Klock, quality control superintendent, Bigelow-Sanford Carpet Co., Inc., Thompsonville; and L. F. Spencer, metallurgist, Landers, Frary & Clark, New Britain.

Their discussion of practical problems proved that there is no mystery to quality control. Demonstration equipment was used during the meeting. After the forum there was a lively open discussion.

* * *

At another recent meeting the Hartford group celebrated its thirteenth anniversary. The function was held at the Gas Co. auditorium under the direction of the newly formed Technical Activities Committee.

William H. Gourlie of the W. H. Gourlie Co., and Paul J. DesJardins, chief engineer, Pratt & Whitney Div., Niles-Bement Pond Co., were the speakers. Their subject was the "New Look in Screw Threads for Fasteners, Domestic, International and Unified."

Mr. Gourlie was one of four men representing the United States at the International Standards Conferences held last summer in Paris, with 27 nations participating. He told the tool engineers what was accomplished toward the unification of screw threads and how the United States influenced these standards.

Mr. DesJardins, who served on this committee a number of years ago, explained why these new standards should be accepted. He sketched the new screw thread forms on a blackboard.

* * *

Seventy-five couples enjoyed dinner, dancing and sociability at the second annual ladies night held lately at Avon Country Club.

EARLY DEADLINE

The March *ASTE News* closed January 31 to step up publication dates of this and the April show and convention number. News received after this date will be included in the earliest possible issue.

Hartford chapter officers responsible for recent ladies night pose with their wives. From left: Robert Edmunds, Robert Toppin, William Allison, Clayton Parsons and Henry Kuryla.

Consumer Goods Improve As Machining Advances

Madison, Wis.—In the first half of the 20th century the mechanical, electrical and chemical industries have made the greatest progress in turning raw materials into consumer goods.

Ernest Sperisen of Gisholt Machine Co. made this statement in a talk on "Manufacturing Methods and Equipment" at the January 10 meeting of Madison chapter.

Refinements in the mechanical field mentioned by Mr. Sperisen include a variety of hacksaws for special purposes and development of the turret lathe for faster metal removal than with the engine lathe.

With the introduction of carbides, machine tools had to be redesigned to take advantage of higher tool speeds.

The milling machine was developed to reduce the cost of metal removal formerly accomplished by planing. At first, soft materials were milled in flat mills that served their purpose as high speed tools were then used.

Carbides Brought Better Machines

But carbide-tipped cutters required speeds that soon burned out clutches and caused damaging wear. This led to the use of flywheels on spindles and greater precision in building the machine to hold the tolerances demanded in modern production. Where milling is accurately done, parts can be assembled without the scraping normally needed when machines are not tight enough to produce a true surface.

Mr. Sperisen stated that in his experience brazed-on cutters were not as satisfactory as solid blades for some types of tools. Holders for special tool bits provide a sharp cutting edge faster with less waste of carbide material.

Cutting speeds on planers also have been increased—from about 20 feet at the turn of the century to a hundred feet per minute with present carbide tools.

The only hope of keeping our price structure from running away, Mr. Sperisen concluded, is through continued lower production cost. He charged tool engineers never to be satisfied with past performance, but to keep striving for even better results.

Present Fuels Limit Ratio of High Compression Engine

Rockford, Ill.—Approximately 300 members and guests of Rockford chapter, attending Past Chairmen's Night January 4 in the Woodward Governor Co. auditorium, heard Marshall McCuen, senior project engineer, Oldsmobile Div., General Motors Corp., discuss "High Compression Engine Development."

One of the men instrumental in the design of the Rocket engine, Mr. McCuen illustrated his talk with slides showing innovations in its construction. Other slides reproduced charts comparing the engine's performance with that of the previous model.

Anticipated High Anti-Knock Gas

Soon after the resumption of automotive production in 1946, Mr. McCuen said, Oldsmobile engineers began work on a new engine design capable of higher compression ratios, to utilize the higher anti-knock quality of expected post-war fuel.

Laboratory and road tests on their then current engine showed that an 8:1 compression ratio was the highest that could be attained before volumetric efficiency began to drop off. Due to lack of crankshaft rigidity, engine action became rough and noisy. And the engine was too long and heavy for the planned displacement.

In a paper presented at the 1947 summer meeting of the SAE, Dr. Charles F. Kettering of General Motors Research, showed that changing compression ratios from 6.25:1 to 12:1 would offer a 40 percent improvement in fuel economy and a 25 percent increase in power output.

Major considerations outlined by Dr. Kettering and subsequently followed quite closely by Oldsmobile were:

1. Design the engine structurally so that it will operate smoothly under the high pressures of 12.1 compression ratio. This meant stiffness in the crankline never before contemplated in an automobile engine.
2. Overhead valves are the best way to get proper engine breathing with the small combustion chamber necessitated by compression ratios above 8:1. In an L-head, the small combustion chamber restricts the flow of gasoline vapor from the valves to the piston.
3. Design engine for cooler intake manifold temperatures and adequate valve cooling to reduce engine detonation and pre-ignition.
4. Design engine of a size to give desired performance with a compression ratio suitable for fuels available when engine is put in production.
5. Design engine so that it can be stepped up to a 12:1 ratio with a minimum of tooling change.

Crankshaft Must Be Rigid

The Rocket design based on these principles is a 90 deg. V-8 engine with five main bearings. Crankshaft rigidity, Mr. McCuen stated, was found a major requirement for smoothness in high compression engines.

Oil thrown off from the drive line splashes on the inner water jackets, lowering maximum oil temperature 25 deg. under severe operating conditions, as compared with the former engine. And warm-up rate of the oil on a cold start was said to be faster and to retard sludge formation.

Another innovation is the self-adjusting hydraulic lifters which largely eliminate the noise problem associated with overhead valve engines.

Because the balance of the revolving parts has to be held closely, weight controlling pads are provided on each end of the connecting rods so that the rods can be machined in production to plus or minus 1/16 oz. on an automatic weight balancing machine. The skirt of the piston is cut away at the front and rear for crankshaft counterweight clearance. To prevent scuffing during the break-in period, the piston is tinplated.

Only a few minor tooling changes, Mr. McCuen added, will be necessary to make the present 7.30:1 engine operate at a 12.5:1 compression ratio, when suitable fuels are available. These engineering revisions are:

1. Change crankshaft stroke.
2. Thicken piston head.
3. Use a copper-lead bearing material.
4. Change ignition system to a higher output coil, a larger distributor cap to prevent cross-firing, and a longer spark plug insulator to prevent flash-over.

At the conclusion of his illustrated talk, Mr. McCuen conducted a question and answer period.

Film Shows New Plant Features

Prior to the lecture the fascinating work of today's motor car designers was shown in detail in an Oldsmobile film, "Styling the Motor Car." The motion pictures presented the evolution of an automobile from an artist's sketch, through the wood frame and clay full-scale sculptured form to the final rendering in steel.

Another film took the audience on a 25-minute tour of the new and modern Rocket engine plant. The camera visit emphasized factory color schemes, lighting, the air removal system, conveyors for chip removal beneath the floor, transfer machines, and automatic inspection machines for gaging and marking cylinder bores.

Got Your Banquet Tickets?

Use the order form on Page 61 for reservations at the annual banquet at Philadelphia, April 13.

Former Chairmen Review Milestones in Progress

Fort Wayne, Ind.—Fort Wayne chapter opened the new year with a Past Chairmen Night, January 11, at the Chamber of Commerce. Each chairman who has headed the group since its inception in 1943 briefly outlined important events occurring during his administration.

The honor guests included Emil Mellin, John Astrom, Milton Kline, Leonard Roebel, Paul Weitzman and John Davis, incumbent chairman. Cyril Grindrod, the chapter's first chairman, was unable to be present.

The chapter has grown substantially each year since its organization meeting held in the Anthony Hotel late in 1942.

Patrick S. Doyen from Detroit spoke on welding tools and dies. A field engineer for the Welding Equipment and Supply Co., the speaker was well versed on the theoretical as well as the practical side of specialized welding. His lecture covered the welding of oil hardening, water hardening, air hardening, and hot working steels.

Prior to his talk, Mr. Doyen showed a sound slide film, "Let's Get the Low Down." Proper procedures and applications for metallic arc tool steel welding were portrayed in the film.

Honor Guests at Fort Wayne's Past Chairman Night included, from left: John F. Davis, incumbent chairman; Leonard Roebel, Emil Mellin, John Astrom, Milton Kline and Paul Weitzman, former chapter heads.

Frazure Transferred, Allison Advanced

Chicago, Ill.—Robert F. Frazure of the Chicago ASTE chapter has been appointed Southwest district manager of Latrobe Electric Steel Co., Latrobe, Pa. the company has announced .

Mr. Frazure will be in charge of sales and service in Kansas, Missouri, Oklahoma, Texas and Louisiana, with headquarters in St. Louis, Mo. Since 1946 he has been Chicago district manager.

Frederick A. Allison of Detroit chapter will fill the position left vacant by Mr. Frazure's transfer. Mr. Allison has been with Latrobe in Detroit for four years, serving first as office manager, then as sales engineer.

Represents Manufacturers

Pittsburgh, Pa.—Frank W. Robertson, a Pittsburgh ASTE member, has announced that he is now a direct factory representative for a number of machinery builders, with offices at 620 Penn Ave., Wilkinsburg, Pittsburgh 21.

Mr. Robertson was formerly associated with Harris Pump and Supply Co.

Coming MEETINGS

ALL CHAPTERS—March. Installation of officers.

CENTRAL PENNSYLVANIA—March 16. Speaker: C. A. Siebert, consulting metallurgical engineer. Subject: "Metallurgical Factors Related to Tool Design." April 20. Speaker: W. B. Pierce, Allegheny Ludlum Steel Co. Subject: "Fabrication Characteristics of Stainless Steel." May 18. Ladies Night. Program to be announced.

CHICAGO—March 14. Chicago Furniture Club. Annual Ladies Night. Dinner and program to be announced. Officer installation by Director Roger Waindle of Fox River Valley chapter. April 4, Allied School of Mechanical Trades. Speaker: Vernon P. Nickell, superintendent of public instruction for the State of Illinois. Subject to be announced. April 11. (Tentative) "March of Research" sponsored by Westinghouse Electric Corp. May 9. (Date tentative) Visit and tour through College of Engineering, Northwestern University.

CLEVELAND—March 10. Cleveland Engineering Society, joint meeting with Society of Automotive Engineers. Speaker: E. V. Crane, chief engineer, Hydraulic Press Mfg. Co., Mt. Gilead, Ohio. Subject: "Plastic Flow of Metals as It Governs Metal Work Operation in Presses." April 3. Joint meeting with ASM at Tudor Arms. Speaker: George P. Tarasov, Norton Co. Subject: "Metallurgical Aspects of Grinding." April 8-9 or 15-16. Annual Cherry Blossom Trip, Washington and Mt. Vernon. May 12. Speaker: J. E. Wallace, superintendent, machine design application, Reliance Engineering & Mfg. Co. Subject: "Latest Developments in Variable Speed Controls for Machine Tools." Coffee Speaker: Wayne Mack, production manager, Radio Station WGAR.

DES MOINES—March 15. Speaker: Jan Taeyaerts, president, Precision Diamond Tool Co., Elgin, Ill. Subject: "Diamonds in Industry."

ELMIRA—April 3. Subject: "Uses and Abuses of Twist Drills," sponsored by Cleveland Twist Drill Co. and presented by their district representative. May 1. Speaker: F. G. Tatnall, mfg. tooling research, Baldwin Locomotive Works. Subject: "Physical Testing—Up-to-Date and Simplified."

ERIE—March 13. Speaker: R. G. Lorraine, General Electric Co., Schenectady, N. Y. Subject: "Atomic Energy in Layman's English." April 4. Plant tour of New Penn Electric power plant, followed by dinner and meeting.

FAIRFIELD COUNTY—May 4. Connecticut Night. May 10. Stratfield Hotel, Bridgeport, Conn. Subject: "Design and Manufacture of Fine Pitch Gears," sponsored by Eastman Kokak Co.

GOLDEN GATE—March 21, 6:30 p.m., El Curtola Club, Oakland, Calif. Speaker: J. P. Crosby, vice-president and sales manager, LaPointe Machine Tool Co., Hudson, Mass. Subject, "Surface Broaching."

NEW HAVEN—May 4. Connecticut Night. May 11. Speaker: Phillip McKenna, president, Kennametal, Inc. Subject: "Carbides."

NORTHERN NEW JERSEY—March 14, Hotel Robert Treat. Executives Night. Speaker: Roy T. Hurley, president, Curtiss Wright Corp. Subject: "Lower Costs by Increased Knowledge of Machines, Speeds and Feeds."

PHILADELPHIA—March 16. Yale & Towne Night. April 10-14. Convention Hall and Commercial Museum, Tool Engineer's Exposition and 18th ASTE Annual Meeting. April 12. Board of Directors meeting. April 13. House of Delegates meeting. May 18. Speaker: W. J. Williams, American Pulley Co. Subject: "Power Transmission."

SAGINAW VALLEY—March 16. Speaker: R. T. Hurley, president, Curtiss Wright Corp. Subject. "Machinability." ASM members invited.

TORONTO—March 24. Annual Dance, Royal York Hotel. April 5, Oak Room, Union Station. Subject: "Tracer Controls as Applied to Machinery," sponsored by John Bertram & Sons, Ltd.

TWIN STATES—April 12, Windsor, Vt. Subject: "Metal Spinning." May 10, Springfield, Vt. Speaker: J. I. Karash. Subject: "Tool Design."

WATERLOO AREA—March. Speaker: R. H. Merchant, Norton Co. Subject: "Uses and Abuses of Grinding Wheels." April 26. Speaker: William Guse, Composite Forge Co., Detroit, Mich. Subject: "Alaska and Northern Canada." Color films. May 24. Speaker: I. L. McBride, Cleveland Twist Drill Co. Subject: "Uses and Abuses of Drills, Reamers and Taps."

Milling Machine Feeds Lag Behind Carbides

Worcester, Mass.—On January 10 Worcester chapter met with the American Society for Metals at Putnam & Thurston's Restaurant. One hundred and fifty metallurgists and tool engineers

W. P. Coomey

J. B. Jacobs

G. R. Fullerton

John Hayes

heard a symposium on the use of carbide tools in machining metals.

Carl D. Schofield of Norton Co., chairman of the ASTE group, presided. Carroll L. Morse of Heald Machine Co. was program chairman. Orun R. Kerst, ASM chairman, spoke briefly.

The four principal speakers drew on their personal experience with carbide in their plants. They described machines utilizing carbide tools at rates of speed not possible 15 years ago.

Joseph B. Jacobs, methods engineer of Morgan Construction Co., cited savings in maintenance costs and time in machining huge steel castings with carbide tools. William P. Coomey, superintendent at Rice Barton Corp., observed that present day milling machine feeds are inadequate to fully utilize the latest carbide tools.

Other speakers were John Hayes, chief tool engineer of Draper Corp., Hopedale, and George R. Fullerton, supervisor of tool control at Whitin Machine Works, Whitinsville.

Quality Control Lifts Worker's Pride in Job

Springfield, Vt.—Clifford W. Kennedy, quality control engineer for Federal Products Corp., Providence, R. I., discussed Quality Control at the January meeting of Twin States chapter.

According to Mr. Kennedy the statistical method of controlling quality of manufacturing operations originated at Bell Telephone Co., approximately 25 years ago. Since this initial application it has been used in widely diversified industries.

Mr. Kennedy gave specific instructions and examples to illustrate the basic techniques. He showed how the theory of the Bell distribution curve applies to the measurement of quality output from any manufacturing process. He discussed techniques of establishing control limits and how to explain control charts to operators.

He advised his listeners that the aim of any quality control system is to provide systematic and reliable quality reports to individual operators, to stimulate their pride in good workmanship. The statistical method of quality control offers savings in the inspection procedure itself, the speaker concluded.

Chairman Lee Davis presided over a business meeting in which the members indicated their preferences among candidates for national directors. The 1950-51 board will be elected at a meeting of chapter delegates in Philadelphia, April 13. Hinckley Ranney, program chairman, introduced the speaker.

Guests at the meeting included three visitors from Massachusetts, Wilfred J. Sheehan of Walpole, Robert D. Schmalz of Franklin and Lawrence Guild of Springfield, and Messrs. Collins and Towle of Hartford, Conn.

Piedmont Group Installs Committee Chairmen

Winston-Salem, N. C.—Nine men were sworn into office as heads of standing committees for the Society's newest chapter during a dinner meeting, January 9, at the Robert E. Lee Hotel.

J. D. Schiller, Piedmont chapter chairman, appointed and installed the following committee chairmen: Public Relations, E. S. Hubbard, and Entertainment, D. W. Riggs, both of Western Electric Co., Winston-Salem; Education, E. J. Zagora, Zagora Machine & Gear Co., Charlotte; Editorial, James M. Reid, and Program, Ned B. Honeycutt, both of The Henry Walke Co., Charlotte; Standards, A. P. Kromer and R. P. Schneider, Western Electric Co., Burlington; Constitution and By-Laws, D. G. Gill, Acme Engineering Co., and Membership, Stanley Langdon, Federal Products Co., both of Greensboro.

J. S. Kirkpatrick, superintendent of research and development, Brooks & Perkins, Inc., Detroit, Mich., was the speaker. His informative talk, "Techniques of Magnesium Fabrication and Manufacturing Process," was augmented by slides on welding, deep drawing, and punching of magnesium. An interesting discussion from the floor followed.

Magnesium, Mr. Kirkpatrick pointed out, is about 35 percent lighter than aluminum. It can be worked in most applications where aluminum is used. But for deep drawing, heat is required, the speaker added.

'Martin Night' Speakers Discuss Aircraft Trends

Baltimore, Md.—Continuing with its new series of manufacturer participation programs, Baltimore chapter presented Glenn L. Martin Night, January 4.

The speakers, all officials of the Martin aircraft company, Middle River, and introduced by Vice-Chairman R. D. Brickett, were: G. T. Willey, vice-president of manufacturing; W. B. Bergan, chief engineer; E. R. Swint, educational director, and R. B. Schulze, supervisor, manufacturing research and development.

Emphasizing control of components as governed by the tool engineer and tool planner, Mr. Willey discussed trends in aircraft manufacture.

Mr. Bergen highlighted his presentation of design trends with motion pictures showing the launching of the Viking and testing of the Gorgon, both guided missiles.

An additional film, "Productivity—Its Benefits," clearly demonstrated how modern production methods increase benefits and decrease costs of commodities to consumers.

The supervisory educational program at the Martin Co. was outlined briefly by Mr. Swint, and Mr. Schulze concluded the program with a resume of the latest tooling techniques developed by his firm, including Marform.

Approximately 150 members and guests were present for the dinner and technical session. A refreshment and question period followed.

Murray Shows How Design Affects Costs, Quality

Bridgeport, Conn.—How to keep manufacturing costs low while retaining high quality and customer acceptance was explained to Fairfield County members during their January 4 meeting at the Stratfield Hotel.

Discussing "Design for Production," Arthur F. Murray, factory manager of the Electrolux Corp., Old Greenwich, stressed the importance of an understanding of each other's problems by the product design engineer, the tool designer and the operating man. Close contact and careful coordination, he emphasized, are vital during the development of a new product.

Should Utilize Standards

Use of national, general industry and individual plant standards was emphasized. Illustrations included materials and constructions available to the designer, with suggestions for proper application.

With diagrammatic sketches Mr. Murray showed design details and before and after examples of design improvements. These demonstrated applications in automotive, electric motor and control, and general machinery manufacture, as well as recent developments in the making of vacuum cleaners.

A sound film depicting advantages of wet belt grinding was shown through the courtesy of the Porter-Cable Co.

* * *

At an earlier meeting Mr. Murray reported on his trip to the ASTE convention at Montreal. "From all indications," he commented, "Canada is doing better than all right with its limited production." But it is being done with World War II equipment, not with worn out machines, he added.

Harold P. Granger, Eastern sales manager for the Bellows Co., was the technical speaker.

Mr. Granger opened his lecture, "Controlled Air Power," by explaining fundamental uses of air as a source of power. A sound picture showed installations in the field. The speaker concluded by exhibiting parts machined by air power.

Prior to the technical session Robert Blake of the Metalmold Corp. talked on navigation and capably answered all questions.

Approximately 60 members and guests were present at the meeting in the Stratfield Hotel.

Cites Oxygen Uses

Nashville, Tenn.—William B. Browning of the Linde Air Products Co., Birmingham, Ala., addressed Nashville members at their January 27 meeting at the Andrew Jackson Hotel. His subject was "Importance of Oxygen in Modern Industry."

Mr. Browning has been closely associated with the development and expanding use of oxygen and other gases in the industrial, medical and scientific fields.

During the meeting the membership elected Sidney Stowell, Horace Sprott and O. W. Dresslar as a nominating committee.

Names Factors Affecting Die Steel Selection

Dallas, Texas—Relative properties of die steels were compared for North Texas chapter members at a recent meeting at the Town and Country Restaurant.

J. A. Nelson, vice-president in charge of metallurgy, Braeburn Alloy Steel Corp., was the guest speaker. He lectured on "How to Select Cold Work and Hot Work Die Steels."

Hot working steels, said Mr. Nelson, should have high strength, impact strength, and resistance to: softening at elevated temperatures, wear and abrasion, heat checking and surface cracking.

While the tungsten group of hot working steels possess greater red hardness and are best able to withstand high working temperatures, they have less resistance to shock in heavy upsetting or forming operations. The chromium steels hold up under heavy blows and sudden temperature changes, retain size and shape during heat treatment.

Cold work die steels were classified as: (1) water hardening carbon tool steels, (2) manganese low-alloy oil hardening steels, (3) high-carbon, high-chromium steels, and (4) air hardening, medium-chromium steels.

Both these and the hot working steels were discussed as to properties, applications, and factors affecting selection.

H. E. Collins, ASTE national director from Houston, was a guest at the meeting and reported on the Society's fall meeting at Montreal.

Debates Business Bigness

Rochester, N. Y.—Is Big Business good or evil? Is it necessary? Why let it grow big—or limit it? What does it do to our economy? How are small businesses affected?

These were some of the pertinent questions of the day debated by Paul H. Rutherford, general manager of Delco Appliance Div., General Motors Corp., before a joint meeting of the Rochester ASTE chapter and the Superintendents and Production Managers Group of the Industrial Management Council, January 9, at the Chamber of Commerce.

Mr. Rutherford's views on this timely subject held the close attention of the 280 executives, administrators, supervisors and technicians present.

Emmett Moore, who introduced the speaker, conducted an open forum at the close of the address. Mr. Rutherford capably answered questions from the floor.

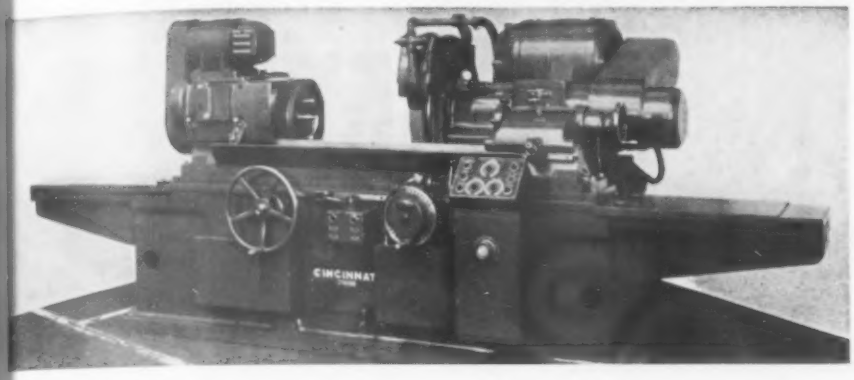
Even after the discussion adjourned, the audience continued to exchange opinions on the subject in impromptu groups.

Walter Wood, chairman of the Superintendents Group and presiding officer at the meeting, welcomed the annual gathering.

William Gordon, ASTE chairman, briefly outlined the chapter scholarship, awarded yearly to the most deserving tool engineering student at the Rochester Institute of Technology.

TOOLS OF TODAY

Filmatic Grinding Machines



Many features of value in grinding medium to large sized parts are claimed for the recently announced Cincinnati Filmatic 14 in. and 16 in. plain Grinding Machines. As with other Cincinnati grinders of this type, the grinding wheel spindle runs on Filmatic bearings, which consist of multiple segments, fixed axially but free to rock radially a slight amount.

Upon rotation of the spindle, wedge-shaped oil films are formed between the segments and spindle and, building up to high pressures, automatically adjust themselves to variations in forces created by the grinding action. Lubrication of Filmatic bearings is automatic. Oil precedes spindle rotation and initiates the starting thereof through a pressure switch. Should the lubricating system fail, the grinding wheel drive motor automatically stops.

The table is traversed by means of a rack and pinion and a simple drive from the motor. Traverse rates are infinitely variable, between 3 and 120 inches per minute, through a DC motor controlled electronically from an AC source. This type of drive is said to offer a smoothness and flexibility comparable to hydraulic traverse.

The electrical system for these machines is further designed to provide automatic acceleration and deceleration of the table at reversal, thereby eliminating shock. In addition, tarry or dwell at each end of the table stroke can be independently adjusted for a time delay of zero to about 18 seconds. Coolant flow and headstock spindle rotation can be stopped and started independently, or in unison with the table traverse. This is also a function of the electrical system.

The headstock is a dead spindle, DC motor driven unit having a No. 13 B & S taper hole in the spindle. Spindle speeds are rheostat controlled and infinitely variable from 40 to 144 rpm for the 14 in. machine, and from 20 to 72 rpm for the 16 in. machine. Matched V-belts and precision silent chain smoothly transmit power from the motor to the face plate.

In line with inherent sturdy construction, the footstock bearing on the table is also much longer than conventional practice, this accomplished by adding an apron extension at each end of the unit. A bellows type dust guard, at the projecting end of the footstock spindle, effectively excludes dust and grit from this important part, while sheet metal telescopic way guards at the end of the table completely enclose the table ways.

Among the many features of these grinding machines may be included automatic wheel balancing. Controlled by a lever reached from the operator's normal working position, the grinding wheel can be quickly balanced without removing the wheel mount from the machine. Hydraulic profile wheel truing fixtures are also available for truing the face and corners of the wheel to a variety of shapes. This equipment has proven entirely efficient in grinding the diameters and adjacent radii on railroad car axles.

When equiped with swivel table type roll cambering mechanism, the 36, 48, and 72 inch length machines can be applied to grinding tinning rolls, strip mill, foil, precious metal and similar cambered rolls. Power cross feed to the wheelhead is also available for roll grinding operations or for any other work which requires frequent and lengthy cross traverse movements.

Complete details of design, and complete engineering specifications may be obtained by writing to Cincinnati Grinders Incorporated, Marburg Ave., Cincinnati 9, Ohio. Ask for their catalog No. G-594. **T-3-1**

See page 70 for handy Tools of Today coupon.

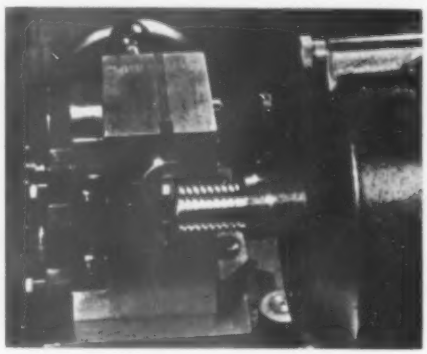
Stainless by Armco

A precipitation-hardening stainless steel—Armco 17-7 Stainless Steel—said to have the strength and hardness of high-carbon spring steels and a corrosion resistance closely approaching 18-8 stainless is announced by Armco Steel Corp., Middletown, Ohio.

It is especially recommended for chemical, petroleum products and food processing industries, for springs and other parts where high strengths and resistance to corrosion are desired. Available in strip, sheet plate and wire. **T-3-2**

Threading Tool Holder

The Warner & Swasey Company, 5701 Carnegie Ave., Cleveland 3, Ohio, announces a retractible Threading Tool Holder for use on the cross-slide of W & S turret lathes. This holder automatically withdraws the tool from the work at any desired point, permitting cuts at full speed close up to shoulders without the necessity for close attention by the operator.



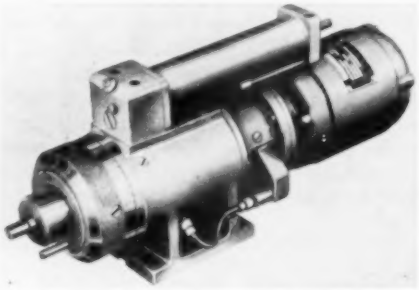
The retractible tool attachment incorporates a spring release mechanism which is cocked by a handle to move the tool forward, and released by a positive adjustable screw stop attached to the headstock. The stop actuates a cam rod in the attachment to snap the tool back from the work. Positive, clean disengagement of the tool from the work is said to be assured while the spindle is rotating.

The device, which is used in conjunction with the apron-mounted chasing screw attachment, and which permits any standard pitch from 4 to 32 to be cut from the square turret, can be furnished for use at the front of the cross slide, or, in a style for use with extra linkage, at the rear.

Applicable to all saddle-type and Numbers 3, 4 and 5 W & S universal turret lathes, the thread chasing attachment can be supplied with a knock-off mechanism for semi-automatic operation if so desired. **T-3-3**

Versatile Drill Unit

An automatic air-hydraulic Drill Unit, acquired from Cleveland-Republic Tool Corporation by Delta Mfg. Division, Rockwell Mfg. Co., Milwaukee 1, Wis., will now be offered in three models: No. 2, of 1/3 HP, maximum stroke 1½ in.; No. 3, 1½ HP, maximum stroke 4 in.; and No. 5, 5 HP, maximum stroke 6 in. These models will be offered with direct motor drive; in combination with gear reduction drives; and also with simple pulley drive.

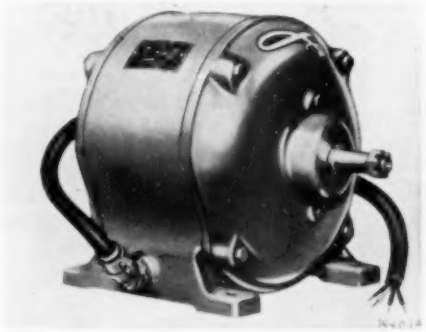


These units are entirely self-contained, with air-hydraulic power providing controlled positive feed at all times. An adjustable rapid approach brings the drill up to the work without striking. Micrometer adjustment on spindle travel is said to control depth of feed stroke within 0.001 in.

Primarily production tools to be mounted in any position on a fabricated bed, singly or in multiple for simultaneous or staggered operation, these units have working parts totally enclosed and protected against chips and coolant. **T-3-4**

Ball Bearing Loom Motor

The Louis Allis Co., Milwaukee 7, Wis., announces a ball bearing Loom Motor on which emphasis has been placed on bearing construction, mechanical stability, electrical performance and over-all loom efficiency under actual mill operating conditions.



Especially engineered for loom drive, these motors incorporate a special stator and motor design which provides medium and high slip and, as claimed, a smoother drive than is ordinarily obtained through use of external flywheels. By this means, power peaks are reduced and regeneration is minimized if not completely eliminated.

The motors are available in ratings ¾ to 2 HP in the 214 and 216 frames for use on old-style looms, also in the new NEMA 224Y and 225Y frames for installation on looms of modern design. Shown in a 216 frame motor of 1 HP rating at 1735 rpm. The "hour-glass" construction permits replacements for old-style motors **T-3-5**

Tool Room Broach Sets

The Kase Machine Co., 18442 Buffalo Ave., Cleveland 19, Ohio, announces the addition of two complete Broach Sets to the standard Glenny line of push broaches. Made available to provide tool rooms with facilities for cutting a wide range of precision keyways, the smaller of the kits—Set No. 10—contains six broaches in sizes ⅜, ½, ⅝, ¾, ⅞ and 1 in. diameter.

Intended for a wider range of broaching applications tool room Set No. 15 contains 10 standard broaches. In addition to the ⅜ to 1 in. range, it includes 1¼, 1⅜, and 1½ in. broaches.

All broaches in the tool room sets feature protected blade design and, as stated, chatter elimination, absolute centering, maximum adjustment for depth of cut, interchangeable blades, simple operation, and rapid keyway cutting. Each broach will accommodate three or four different width blades, depending upon broach size. Standard tooth form provides a large chip chamber. Furnished in polished wood cases, fitted with racks to provide maximum tool protection. T-3-6

Use This Coupon for Complete Information On Tools of Today Items Featured This Month

For your convenience, a key number follows the announcement of each product reviewed in the *Tools of Today* section of THE TOOL ENGINEER. To obtain complete information on any of these products, circle the corresponding key numbers on this coupon, and mail the coupon to THE TOOL ENGINEER.

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T-3-1	T-3-2	T-3-3	T-3-4	T-3-5	T-3-6	T-3-7	T-3-8	T-3-9
T-3-10	T-3-11	T-3-12	T-3-13	T-3-14	T-3-15	T-3-16	T-3-17	T-3-18
T-3-19	T-3-20	T-3-21	T-3-22	T-3-23	T-3-24	T-3-25	T-3-26	T-3-27
T-3-28	T-3-29	T-3-30	T-3-31	T-3-32	T-3-33	T-3-34	T-3-35	T-3-36
T-3-37	T-3-38	T-3-39	T-3-40	T-3-41	T-3-42	T-3-43	T-3-44	T-3-45
T-3-46	T-3-47	T-3-48	T-3-49	T-3-50	T-3-51	T-3-52	T-3-53	T-3-54
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T-3-64	T-3-65							

Name .....

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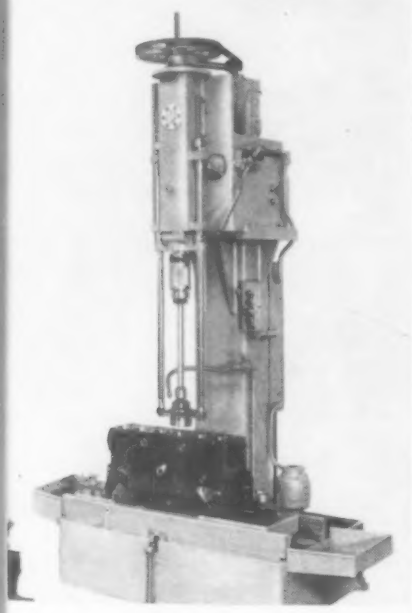
Heavy-Duty Hydrohoner

A general purpose, heavy duty semi-production Honing Machine, by Micro-matic Hone Corporation, 8100 Schoolcraft Ave., Detroit 4, Mich., is designed to hone any bore from 1 in. to 4 in. diameter and up to 10 in. in length. This machine—Model 718 Hydrohoner—is said to have all the performance features of a production machine.

Operation is simplified by having all controls of the movement of the hydraulically reciprocated head on the Uni-Control lever. The tool is "inched" into the bore, rotation is started and stopped, the reciprocation speed is regulated and the tool is withdrawn from the bore by the manipulation of this one lever. The tool is expanded by an adjusting sleeve, on the head, that does not rotate with the tool. Stock removal and size can be easily computed and controlled by a calibrated ratchet ring on this sleeve.



The machine is said to be particularly adaptable to the reconditioning of parts such as automotive cylinder bores and connecting rods. With a lateral indexing table mounted on the base—as shown in the illustration—any type of block can be reconditioned to factory tolerances, nor is it necessary to remove the crankshaft bearings or the studs. The block is located by pins, held down by quick-lock clamps, and the table is positioned for each cylinder by an indexing bar. Reboring is not necessary, and stated production rate is from 5 to 8 blocks reconditioned per hour.

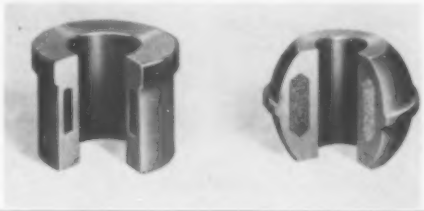
For reconditioning connecting rods, a riser block is mounted on the table with a universal type fixture that will hold any automotive rod. Production stated is from 60 to 90 rods per hour with from 0.004 to 0.010 in. stock removal.

T-3-7

See page 70 for handy Tools of Today coupon.

Impregnated Bearing

The Haller Oil Well Bearing, by Michigan Powdered Metal Products Inc., Northville, Mich., introduces a method of forming a cavity of uniform size in the center of a bearing wall. As oil or grease is impregnated into the sintered metal by static pressure, it fills this cavity or pocket as well as the pores of the sintered metal body. This results in a considerably greater oil content than would be possible with conventional bearings.



The combination of increased lubrication and a stronger bearing metal is said to make it possible to take heavier loads and to practically eliminate "freezing" under adverse operating conditions. Because the oil is sealed in the body of the bearing, there is no oil drip.

Supplied in three types—pocket, sponge, and thin wall—the bearings are suitable for a wide range of bearing applications and, as they can be hardened and ground, they can also be used as guide pin bushings. T-3-8

"We can't afford thousands of dollars for special machines"

"but no production unit we've seen approaches low cost of Dumore Handgrinders!"

says C. A. Ewing, Supt. of Raush Nut & Mfg. Co., Cleveland. Using special fixture with adjustable table (cost $50 - $75) and mounting Dumore Series 8 or 10 handgrinder, Raush Nut deburrs up to 500 stainless steel hex nuts per unit per hour. Total cost per 100 including grinder, fixture, current, supplies and labor is less than 36¢.

"Still Own Every Dumore Ever Bought"

Raush Nut owns 30 Dumores, some as old as 15 years, uses them in tool room and maintenance, as well as production . . . operated most of them 24 hrs. per day at peak production. No wonder Supt. Ewing says, "High speed and precision built into Dumore Grinders insures accuracy and trouble-free production!"

Ask your Dumore Distributor to show you, in your own shop, how Series 8 and 10 handgrinders can up your finishing output, slash your costs. Call him today or write for literature to: The DUMORE COMPANY, Dept. C-43, Racine, Wis.

DUMORE DH-1

P.S. For lower costs on internal and external grinding, light milling and drilling, investigate Dumore High-Speed Spindles.

Radical Tapping Attachment

A Tapping Attachment—the S.P.V., by Svenska Precisions-verktyg, Nacka, Sweden—employs a novel arrangement of balls and a slipping clutch to provide accurate and safe tapping at spindle speeds up to 2500 rpm. As claimed, light metal may be tapped at 300 ft. per minute, brass at 180 and tool steel at 90 fpm.

The attachment is so designed that, on all but the toughest materials, blind holes may be bottom tapped without breakage, the tap stopping automatically on reaching the bottom of the hole. While no lead screw is required with this attachment, the tap nevertheless picks up the thread when retapping.

The attachment is available in four sizes — SA-0B, SA-1B, SA-2B, and SA-3—taking taps from 1/16 to 2 in. However, it is stated that the latter size has been used to tap holes in Siturnium Gamma up to 6 in. X 0.078 pitch. It may further be used for drilling, reaming, and stud driving, and with practically any machine tool. **T-3-9**

CHAMPION

Precision Expanding Mandrel

Entirely new in principle, this positive drive, quick change work mandrel cuts handling time . . . guarantees concentricity . . . eliminates arbor pressing and colleting. Ideal for use on any job where precision and time-saving are of utmost importance.

Lower cost production is assured with faster work, fewer rejects and less tool cost. Arbor is built for heavy loads. Sleeve has range of .010". Closes at .003" under and opens at .007" over nominal size. Positive stop at maximum size prevents overstrain. Holds tolerances of less than .0001" run out.

Standard sizes from ½" through 3" diameter, graduated by 1/16", fit your machine. Special sizes made on order. Write for more information without obligation.

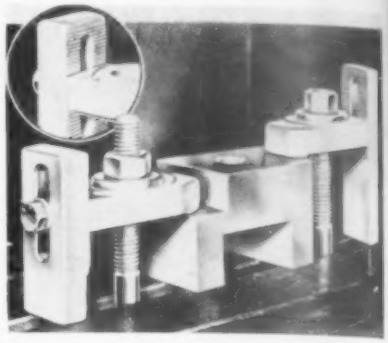
Expanding Mandrels
Heavy-duty Racks
Industrial "C" Clamps
Grinder Dressers

See our display
BOOTH 1118
at the ASTE SHOW

The WESTERN Tool & Mfg. Co., Springfield, Ohio

Adjustable Clamps

Eliminating the customary usage of slotted strips of mild steel and odd assortments of shims as clamping devices, the English-made Hamber Clamp provides powerful clamping for holding down workpieces on the tables or faceplates of milling machines, lathes, boring machines and other machine tools. Marketed in the U. S. A. by Montgomery & Co., 53 Park Place, New York 7, N. Y.

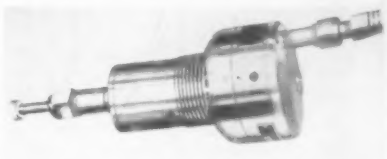


These clamps can be infinitely adjusted up to 6 in., and two complete sets of clamps on each machine should provide the user with all he requires to hold down the heaviest job.

Each clamp consists of a horizontal part and an upright. The meeting surfaces of both parts are provided with machine serrations of 16 pitch so that the two parts can be locked at any height by means of a high tensile steel bolt. The bottom face of the uprights is milled to a 2 in. radius, which will allow slight tilting of the clamp to adjustments within the pitch of the serrations. The parts are made of best quality steel forgings, and can be supplied individually or in complete sets. **T-3-10**

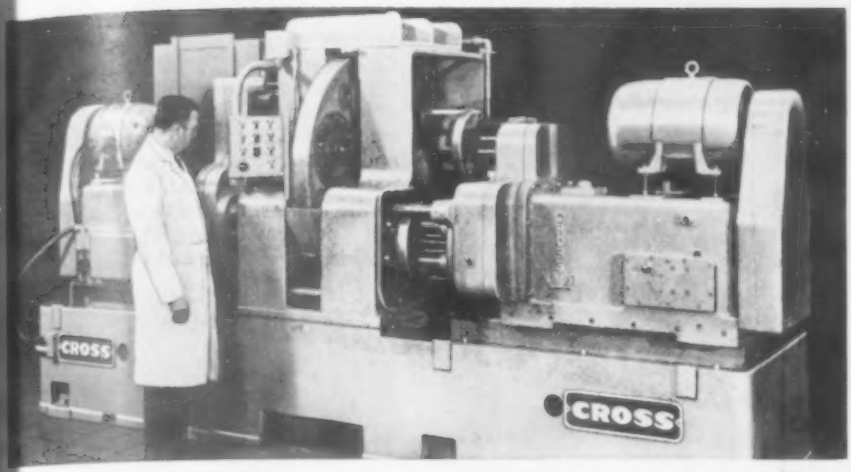
Air Turbine Grinder

An Air Turbine Motor, by the Onsrud Machine Works, Inc., 3927 Palmer St., Chicago 47, Ill., features automatic governor control. One of the main applications for this motor is in the Onsrud D1-G Air Turbine Grinder, a ½ HP, 50,000 rpm unit. In operation, as the grinder is held against the work and a resistance is built up that begins to reduce rpm, the automatic governor cuts in a greater air volume to maintain rotational speed.



When the work load is removed, the effect of greater air supply under governor control will be to speed up rotation beyond 50,000 rpm. When this happens, the governor again acts, reducing air supply to normal. By this means, relatively constant speed within close limits is maintained for spindle rotation. **T-3-11**

Flywheel Machine by Cross



A new special Machine Tool for machining automotive flywheels with an unskilled operator, designed and built by the Cross Company, 3250 Bellevue, Detroit 7, Mich., drills, chamfers and reams flywheels at a stated rate of 140 pieces per hour at 100 percent efficiency. It is a 5-station index trunnion type with a fluid motor for indexing.

At station 1, the operator loads and unloads; at station 2, 16 holes are drilled; at station 3, 16 holes are chamfered; at station 4, 15 holes are chamfered; and at station 5, 3 holes are reamed. The operator merely positions the part in the loading station and presses the cycle button.

To provide flexibility for reasonable part design changes, standard Cross sub-assemblies are used, these units also assuring minimum down time and low maintenance costs. Other features include hardened and ground ways, and hydraulically operated feed and rapid traverse. **T-3-12**

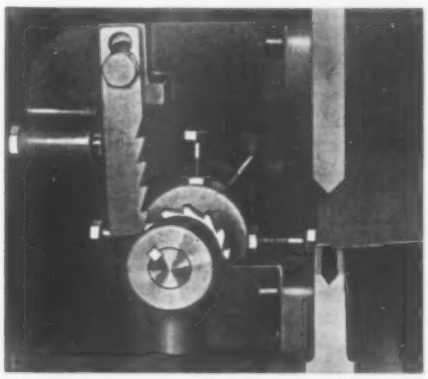
Hardening Compound

The Miracaloy Corporation, 50 Broadway, New York 4, N. Y., announces a low-cost quick acting steel hardening compound, Hard-N-Deep.

A powdered chromium-carbon material, it contains an exclusive Catalyst, KL-7, said to speed up the hardening process and to allow the compound to work at relatively low temperatures. Under the action of heat the compound penetrates the surface of the part being treated and produces a carbonizing, nitriding and chromizing action. **T-3-22**

Automatic Gage Press Brake

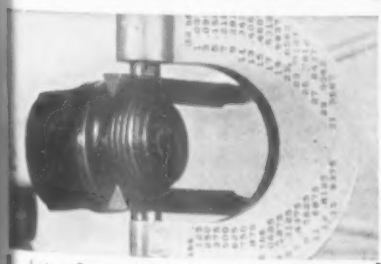
Humphrey "Rodex" gauge, by the General Gas Light Co., 202 North Park St., Kalamazoo, Mich., is an automatic, self-indexing rotary type gage for press brakes designed to make possible the producing of as many as four different bends in a piece of metal before it leaves the operator's hands. Ease of setting accurate gaging and a saving of material handling time are claimed for the tool.



The gage consists of a rack and gear assembly which automatically rotates adjustable gage stops into position and holds them securely until a bend has been made. The rack, which is attached directly to the punch, engages the gears and, on the upstroke, brings the stops to position required for a bend.

Provision is made for disengaging the rack from the gears to permit the use of the gage as a single-stop gage. The stops are strategically located in rotating member to meet practically any bending equipment. **T-3-14**

THE SIMMONS SYSTEM



Latest System for accurately measuring 60° Threads. Just add chart constant to the thread O. D. and "mike" across the triangles to get the answer. As simple as that!

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DRILL

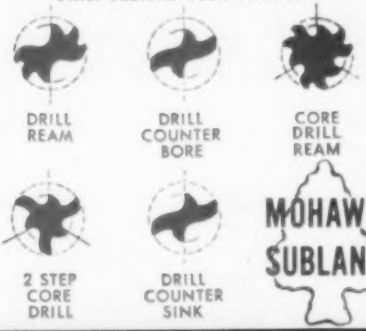
Smaller than the tap and yet larger than root dia. Circle ground its entire length.

TAP

Available in NC and NF threads in standard sizes ¼" to ¾".

Price lists available on request

Other Subland Tools Available



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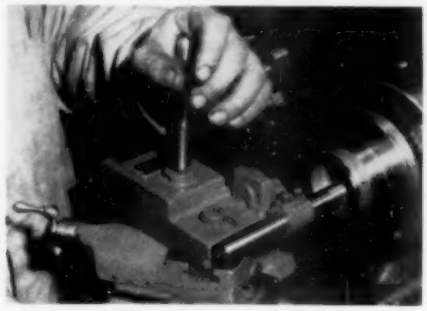
Simple Threading Attachment

Designed for internal and external thread chasing, the Motch & Merryweather "Meritool" automatically retracts the lathe tool from the work at any desired setting and simplifies the chasing of precision threads.



The tool is quickly mounted on any 9 to 11 in. V-wayed lathe and may be used by operators of average skill for small or large lot production runs on thread chasing. Descriptive literature may be had on request from the Motch & Merryweather Machinery Company, 715 Penton Building, Cleveland 13, Ohio.

T-3-15

Variable Speed Drive

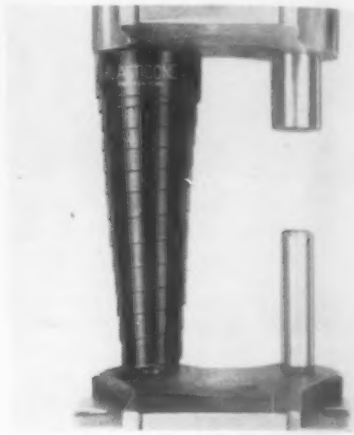
A smaller, low-cost ¾ to 2 HP Variable Speed Drive, by Reliance Electric and Engineering Co., 1060 Ivanhoe Road, Cleveland 10, Ohio, is adaptable to a wide range of machinery as original equipment or for application to machines already in use.

Taking power from AC lines, drive is said to provide smooth starting, jogging, for set up, and adjustable speed over a wide, stepless range. Included as optional features are rapid dynamic braking and reversing. As wiring is the only connection involved between the three elements—operator's station, control unit and motor—these may be disposed in most advantagous locations.

T-3-16

Guide Pin Cover

Punch press operators are safeguarded from injury, and machines from excessive wear and damage, by a Guide Pin Cover produced by the Central Safety Equipment Company, Philadelphia 21, Pa. Known as the "Elasticone," this safety device entirely encloses the pin and bushing area and completely eliminates the pinch-point, a major hazard to die setters, maintenance and operating personnel and to supervisors working around punch-press die sets.



The guide-pin cover is a cone-shaped, spiral-wound, flat-steel spring of special alloy and temper that may be inserted easily over the pin and bushing between the upper and lower shoes of the die set. There is no necessity to drill holes in the equipment since the cover is held in position by its own spring tension. No tools are required to install, and all adjustment is automatic.

The Elasticones may be obtained in sizes to accommodate punch press die sets with bushing diameters ranging from 1½ to 6 inches, and with open heights ranging from 4 to 24 inches. Descriptive folders are available, listing stock sizes and current prices. According to the manufacturer, trial sets for inspection and approval will be sent on memorandum billing.

T-3-17

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Granite Precision Parallels

Precision parallels, as announced by Kahn Granite Surface Plate Co., 1149 Platt Circle, Dayton 7, Ohio, are made of black granite to a claimed overall tolerance of 0.00005 in. in a set, in sizes from ½ x 1 x 6 in. to 1 x 2 x 12 in. Larger sizes can be made up to 4 x 6 x 20 in.

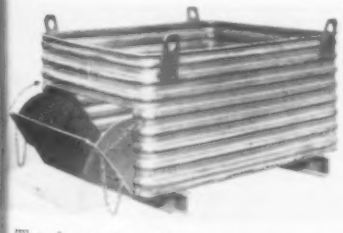
These granite parallels are produced by hand lapping instead of grinding, as is done on steel parallels. Original accuracy in manufacture is said to be maintained indefinitely due to the nature of the black granite which, harder than tool steel, has been normalized and stress relieved by eons of aging. The granite will not rust and, should it be accidentally nicked, no burr will be raised. Neither can abrasives become embedded in this hard material.

Illustrated is an application of 1 x 2 x 12 in. precision granite parallels on a precision granite surface plate. These parallels are recommended for use only where extreme accuracy is required and by persons trained in the care of precision instruments. They are generally packed in pairs in oak cases, but any reasonable number can be supplied in a set to the claimed overall accuracy.

T-3-18

Hinged-Door Stacking Box

A corrugated steel Stacking Box with a chain operated hinged door is announced by Palmer-Shile Company, 12621 Mansfield Ave., Detroit 27, Mich. The door may be opened to any set angle by means of the chain, thus simplifying parts disposal by standing or sitting workmen.



The door also eliminates the necessity of removing tiered boxes when it is desired to dispose of parts in boxes not at the top. The boxes are built to dimensions and load capacity specified by the customer, including underneath clearance. Crane lugs, stacking brackets, and color of paint desired may also be specified.

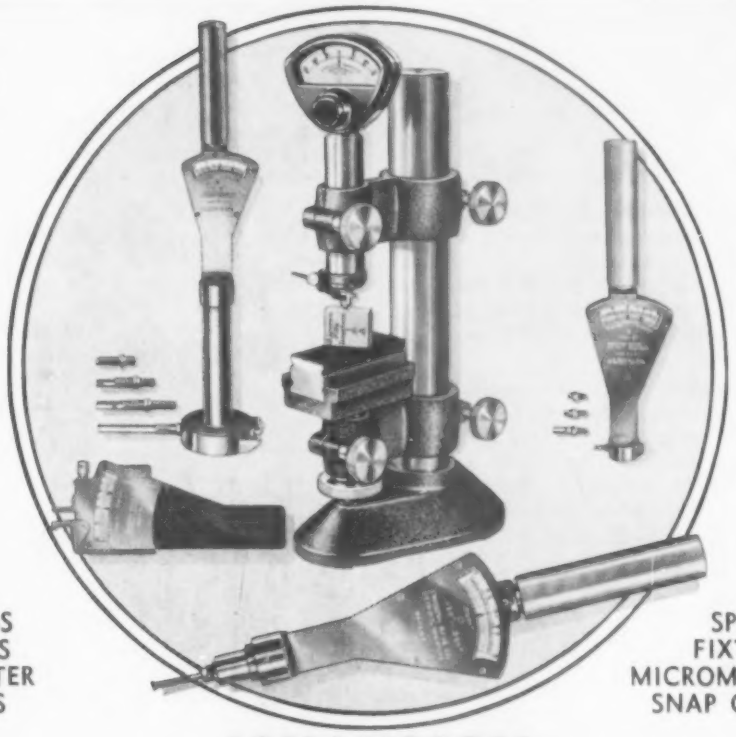
T-3-19

Safety Reel Dispenser

Safe handling and storage of band saw stock; easy selection of any desired length; immediate identification of contents and amount on hand; complete protection from rust, dirt and damage—all of these advantages are said to be enjoyed by users of band saw coil stock made by the L. S. Starrett Company, Athol, Mass.

An easy-to-use, safety Reel Dispenser holds a 100 foot coil secured by a revolving arm which keeps the coiled stock safely in place at all times and, when rotated, releases any desired length. A cut-out on the side of the reel shows instantly the approximate amount of stock remaining. Each reel is clearly labeled to show width, type, gage and teeth-per-inch of contents.

T-3-20



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THE JOHANSSON INTERNAL INDICATOR GAGE is a reliable precision indicator especially designed for rapid, convenient and accurate measurement of internal diameters. Variations of as little as 0.00005" in size, out-of-round, and taper of bores can be quickly determined. Hundreds are in daily use on production lines and in inspection departments of innumerable applications where close limits in size, roundness and straightness of bore are of prime importance. It can be set to any required size direct from Johansson Gage Blocks or Master Ring.

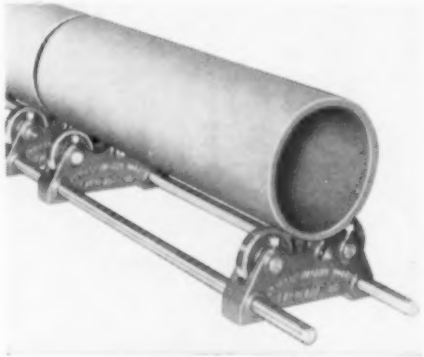
THE JOHANSSON MIKROKATOR GAGE (amplifier) assures positive, dependable, repeat readings . . . Pointer responds instantly to slightest movement of measuring tip without swinging past true reading. No waiting for pointer to come to rest. Effects of vibration negligible owing to light weight and absence of inertia. No racks, gears, levers, lag or back lash. No electrical connection. Complete assembly of instrument and stand light enough to be easily carried to different locations in shops. Graduated—.0001 to .000002"; .01 to .0001 mm.

SWEDISH GAGE CO., OF AMERICA
8900 ALPINE AVE., DETROIT 4, MICH.

C. E. JOHANSSON GAGE CO.—A DIVISION

Rotary Work Aligner

Johnson Machine Works, Eau Claire, Wis., announces a rotary Work Aligner for handling all types of materials requiring rotation in manufacture, assembly, welding or repair. Said to insure perfect alignment of two or more pieces of work, it eliminates expensive setups for miscellaneous jobs and is adapted to either centered or uncentered work.



It may also be used to check alignment or run-out on any circular material up to 24 in. diameter. There are no limits to the length of material that can be worked as two or more of the aligners may be used in handling long sections.

A precision tool, its operation is simple and easy. The tool is designed and built with a ruggedness to withstand the severest use over a long period of time. At present, four models are being produced in bed lengths from 5 ft. 10 in. to 11 ft. 6 in. with a load capacity of 1500 pounds. **T-3-21**

"Biggest" (?) Foot Press

What is claimed by Whitney Metal Tool Co., Rockford, Ill., as "the biggest Foot Press in the world" has a 4-ft. throat depth as compared to normal presses of the same design in the Whitney-Jensen line, which run 7, 10, 18, and 24 in. throat depth. The machine was designed for punching holes along the edges of standard 4-ft. sheets of hard, compressed composition board. Because of the tendency of the board to tear, punching the holes is said to produce cleaner results than drilling. **T-3-22**

Vibrationless Saws

W. F. Meyers Co., Bedford, Ind., announces the Meyco "Vibra-Free" Saws which, according to the maker, are processed to eliminate uneven stresses and strains in carbide-tipped circular saws. It is further said to eliminate objectionable "sing" and vibration, thus resulting in smoother cutting and longer life of the saws.

This improvement is the result of cutting slots in the saw blanks similar to spokes in a wheel, and filling them with a material having different harmonic qualities than the steel saw body. By this method, objectionable noise and vibration are controlled at their source. The slots are so designed that when the disharmonizing material is inserted, it becomes self-locking and therefore safe in use.

The Vibra-Free design allows the relieving of brazing stresses—permitting as many teeth in the saw as are required to do the job, without getting the high pitched whistle which is often an objectionable condition encountered in carbide saws. **T-3-23**

Two-Way Floor Magnet

Long, low-clearance handles feature the Series D Rotary Floor Magnetools announced by Multifinish Mfg. Co., Dept. 528, 2114 Monroe Ave., Detroit 7, Mich. The long handles permit the operator to pick up steel chips from under places not otherwise accessible, without stooping. Only 2¾ in. clearance is required. There are no wires, so area of operation is unlimited.

Magnetools may be used on floors, driveways, in tanks and many other areas where steel chips, nails, screws, or other ferrous particles are a safety or scrap problem, or where rapid removal of steel parts is required. The magnets are permanent and sealed in a tube.

The Magnetool is propelled carpet sweeper fashion, a powerful magnetic tube rotating with the wheels. Steel parts jump to the tube and load automatically, with unloading by means of a Neoprene wiper ring which pushes parts to a non-magnetic area at either end, where the entire load is instantly released. **T-3-24**

Dial Bore Gage

The Rimat Machine Tool Co., 1117 Air Way, Glendale, Calif., announces a Dial Bore Gage in ranges ½ to 6 in. Utilizing a design based in the Rimat inside micrometers, these gages can be used with equal facility for rings, shallow or deep holes. Readings show instantly on the dial.

The instrument is produced in two series. Series "S" gives direct readings in thousandths over the entire range and the "T" series gives plus or minus indications in tenths. Standard tip sizes are 1/16 and 1/8 in. on specific models. **T-3-25**

Height Gage Scope

The "Height Gage Scope," by the Quality Control Company, 6356 Hollywood Boulevard, Los Angeles 28, Calif., combines the features of a telescope with a microscope and attaches to any 18 in. or 24 in. height gage to make a universal shop inspection instrument. It has 5X magnification, coated lens, internal focusing, a wide field, and provides an erect image throughout a working distance of 2½ in. to infinity.

The instrument measures dimensions which can be seen but not touched. The dash-lined crosshair is said to distinguish 0.001 in. at two ft., and has a concentric circle for picking up hole centers. Measurements are read directly on the height gage vernier. With the height gage mounted horizontally, the instrument serves as a useful toolroom microscope.

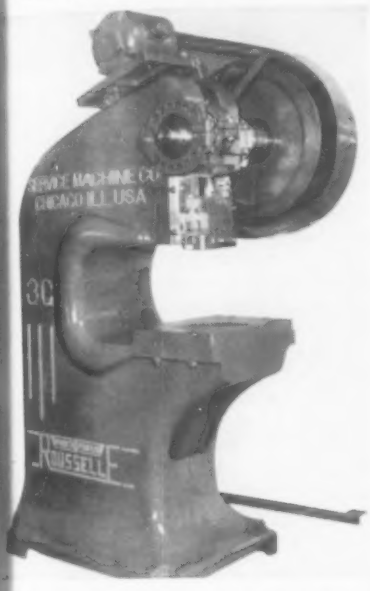
The Height Gage Scope replaces the scriber or indicator for checking hard-to-reach places such as dimensions on points, wires, grooves, engraving, and through transparent objects. Inspection of tapered cylinders, recesses, ordinate stations on templates and cams is made relatively simple. **T-3-26**

See Page 70 for Handy Tools of Today Coupon

25-Ton Deep Throat Press

A 25-ton Rousselle Deep Throat Press, No. 3-G—, has been added to the regular line of standard and special punch presses manufactured by the Service Machine Company, 7627-33 S. Ashland Ave., Chicago 20, Ill.

This press has an 18 in. throat which permits working to the center of 36 in. sheets, making it ideal for fabricating shops to increase their scope of press operations as well as save time and material by using wider sheets.



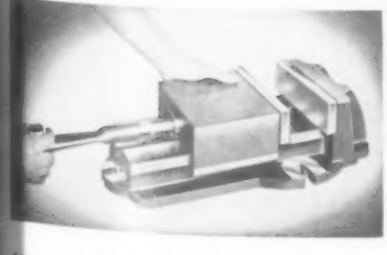
The standard bolster plate measures 14 x 20 in.; however, larger bolsters and punch holders can be furnished. The frame is an extra heavy semi-steel casting, heavily reinforced and is designed so that the bed protrudes, allowing clearance for some jobs that ordinarily would require horn presses.

This deep throat press is equipped with a single stroke or continuous clutch, roller bearing flywheel, extra long hardened and ground ways, operates at a speed of 125 rpm and weighs approximately 3200 pounds. **T-3-27**

Precision Machine Vise

Ames Precision Machine Works, Waltham 54, Mass., announces the Ames Precision Machine Vice, Model 8 which, in addition to quick operation and powerful grip, features an unusually large jaw opening.

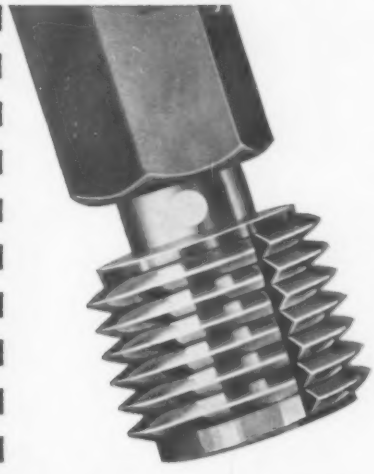
The jaws, which are 8 in. wide, open to a full 11 inches. Opening and closing is instantly effected by a slight turn of the wrench, with the sliding block quickly moved to any position with its range. The tool is durably built for long life. **T-3-28**



Plastic Panel Meters

Three popular sizes of precision Pyrometers for panel mounting, with unbreakable, clear plastic, one-piece front covers, are announced by Assembly Products, Inc., Clarion Falls, Ohio. Eight ranges cover temperatures from minus 75 deg F to 3000 deg F, with corresponding ranges of minus 60 deg C to 1600 deg C. Both Fahrenheit and Centigrade are shown on the dials, with standard calibrations for Chromel-Alumel and for Iron-Constantan thermocouples. Other types including platinum couples on special order.

250 microamperes full scale sensitivity or four ohms per millivolt. Easily adapted to various lengths of thermocouples from a few inches up to 100 feet or more. Movements are designed for rugged industrial service with oversize moving coils, Alnico V magnets and sapphire jewels. Model 451—the largest—measures 4½ x 3⅞ in., has scale length of 4 in.; Model 351 measures 3¾ x 3⅜ in., has scale length of 3⅛ in., and Model 261—smallest of the three—is 2⅝ x 2 7/16 in. scale length 2½ in. **T-3-29**



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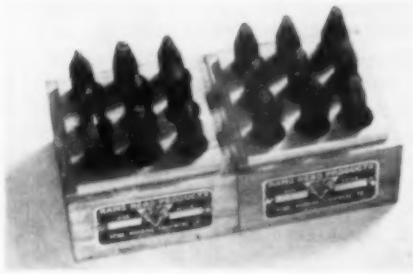
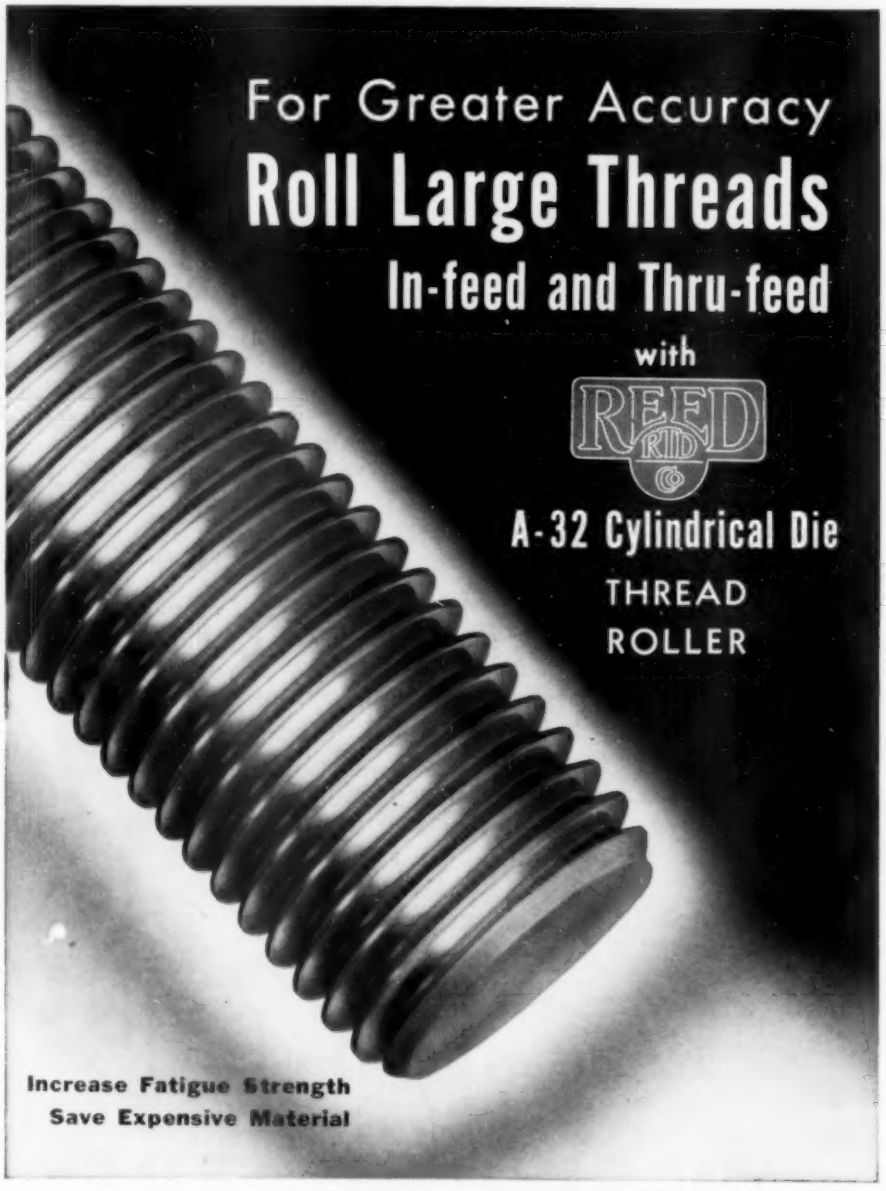
Fractional Figure Stamps



The production of a larger set of fractional figure Metal Marking Stamps is announced by the Acme Marking Equipment Co., 8030 Lyndon, Detroit 21, Mich. The set consists of 18 specially hardened steel stamps, giving 1/16 separations, and is offered in a choice of three sizes: 1/8, 3/16, and 1/4 in. from top to bottom of entire fraction.

Of the 18 stamps in the set, 16 are fractional figures as follows: 1/16, 1/8, 3/16, 1/4, 5/16, 3/8, 7/16, 1/2, 9/16, 5/8, 11/16, 3/4, 13/16, 7/8, and 15/16. To these are added the whole number "1" and an inches sign —"— to be used in conjunction with any of the other stamps. The stamps in each set are furnished in two sturdy, compact hardwood cases, with separate compartments for each stamp. **T-3-30**



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Manufacturers of
THREAD ROLLING MACHINES AND DIES • KNURLS • THREAD ROLLS
Worcester 2, Massachusetts, U.S.A.

TE-015

"Negator" Clamp Kit

A "try-it-for-size" kit—No. NC-11—of Negator clamps is announced by Hunter Spring Company, Lansdale, Pa. As the illustration shows, these unique clamps are actually opposed coiled springs which, depending on size, exert pressures from 5 oz. to 18 lbs. Instantly opening from 3¼ to 20 in., these clamps are useful for almost unlimited applications of lighter clamping, among them temporary holding of components during assembly or welding. T-3-31

Pre-Heating Units

Electric Arc, Inc., 152-162 Jelliff Ave., Newark 8, N.J., announces its combination for pre-heating before welding and stress relieving after welding—the 40 KVA Model RTA Regulating Unit and the 40 KVA Model AC3 low frequency Induction Heating Unit by the Smith-Dolan System.

This combination is designed for use in limited space. The RTA Unit shown is arranged for operation on 220/440 and 550 volts at commercial frequencies, and the AC3 Heating Unit is small enough to be placed near the work with easy accessibility.

With these models more equipment can be added as required, and when larger jobs are contemplated, the AC3 Unit can also be used as a booster unit with other Smith-Dolan heating equipment. Further described in company literature. T-3-32

See page 70 for handy Tools of Today coupon.

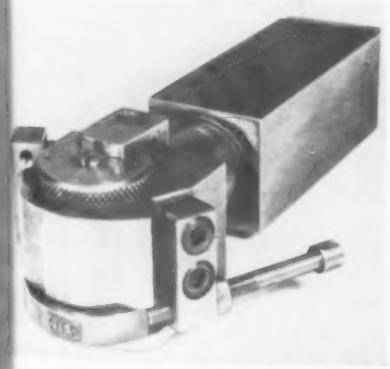
Pocket Comparator

The Pocket Comparator is a precision optical measuring instrument for the inspection of small parts or small dimensions on large parts. It permits the user to compare, through a magnifying lens, the part to be checked against a finely calibrated pattern or reticle. Magnification is approximately 1 to 1. The instrument, developed and manufactured by Bell and Howell Company, is distributed by National Tool Company, 11200 Madison Ave., Cleveland 2, Ohio.

The reticle of the Pocket Comparator is calibrated for measuring lengths, widths, complete circles, radii and angles. Its upper part has lengths graduated in steps of 1/64, 1/32, 3/64, 1/16, 1/8, 3/16 and ¼ in. There is also a linear rule of ½ in. with 0.005 in. increments and a 10 mm linear rule with 0.2 mm increments. Circles are shown graduated from 0.002 in. to 0.050 in. diameter and from 1/64 to 1/16 in. diameter. The lower half of the reticle is patterned to measure angles between 0 and 90 deg in steps of 5 deg, and to measure radii from 1/16 to 3/8 in.

T-3-33

Automatic Marker



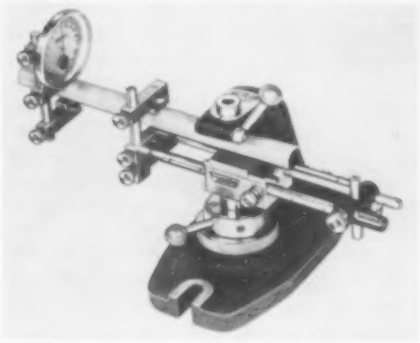
An automatic marking device—the "Automarx," by The Special Screw Products Co., 5445 Dunham Rd., Bedford, Ohio—is designed to roll-stamp part numbers during processing in multi-spindle screw machines. Therefore, it eliminates the need of separate stamping operations.

Mounted between positions on the machine, the device leaves all stations free for other operations; thus, it marks during index. An adjustable head permits quick setting for round stock ¾ in and over, and for regulating depth of imprint.

T-3-34

Universal Drilling Tool

A universal Drilling Tool—the "Reglus"—is designed to simplify drilling of holes at predetermined intervals, adjacent holes for broached slots, holes in balls and at any radial angle. With attachments, it is said to permit exact drilling of round, flat, square or rectangular workpieces within 0.0003 in. accuracy.



Although primarily a drilling fixture, it is versatile and may be used as an angle comparator in two planes, as a center distance comparator and as a depth gage. The tool holds workpieces up to 1¾ in. in diameter and takes interchangeable drill bushings from 3/32 to 11/32 in.

Of Swiss manufacture, the tool is exclusively distributed in the United States and Canada by the Cosa Corporation, 405 Lexington Ave., New York 17, N. Y. **T-3-35**

WITH MERZ UNIVERSAL CHECKING PLATES

MERZ Universal Checking Plates are of unique design, with all attachments connected on the outside. The result is 50% more working surface—an advantage found only in MERZ.

You can depend on Merz Checking Plates and Fixtures to speed up complicated checking operations. Bench centers and "V" blocks are fitted by exclusive design, with angle groove in master plate and attachments. This maintains positive pressure against edge and surface at all times. Various attachments, including a 20" sine bar fixture, offer a wide range of checking combinations not available with standard units.

MERZ Universal Checking Plates and Fixtures are cast from special, fine-grained gray-iron alloys—are extremely rigid and unconditionally guaranteed against warpage. Available in a wide range of sizes to meet every requirement.

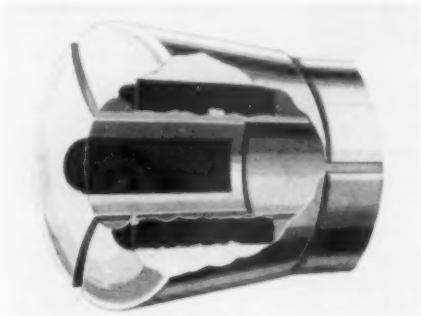
MERZ builds a complete line of precision inspection equipment, including AGD standard plugs and gages and well-known *New-Matic* Measuring Machines, Taper Gages and Automatic Sorting Machines. Write for illustrated technical data.

MERZ ENGINEERING COMPANY • INDIANAPOLIS 7, IND.

MERZ

Collets Salvaged

S & E Machine Products, Inc., Bridgeport, Mich., announces a process for salvaging collets and feed fingers



normally worn oversize. To reclaim used, worn collets and feed fingers and restore them to original precision, carbide wear sections are inserted and ground to original or new collet dimensions. This reworking is especially adapted to collets used in high speed automatic work or similar long run applications where accuracy must be maintained wtih minimum down time.

The process involved in this reworking eliminates annealing; thus, the original hardness and temper are not appreciably changed. The manufacturers state that while this process has but recently been introduced, it has been well proven over the past year and a half on experimental applications. T-3-36

NOW

L & I QUALITY GROUND REAMERS NOW AVAILABLE IN SIZES:

STUB SCREW MACHINE REAMERS — #00 to #23

HAND REAMERS — Straight and Spiral Flutes — 1/16" to 2"

EXPANSION CHUCKING REAMERS — Straight and Taper Shank — 1/2" to 3"

CHUCKING REAMERS
Straight Shank — Straight and Spiral Flutes — 1/16" to 1-1/2"
Taper Shank — Straight and Spiral Flutes — 1/4" to 1-1/2"

ROSE CHUCKING REAMERS
Straight Shank — Straight Flutes — 1/16" to 1-1/2"
Spiral Flutes 1/16" to 5/16"
Taper Shank — Straight Flutes. — 1/4" to 1-1/2"

TAPER PIN REAMERS — Straight, Spiral and Helical Flutes — #7/0 to #10

HELICAL DIE MAKERS' REAMERS — AAA to U

CENTER REAMERS — Fluted Type — 1/4" to 3/4"

Write for catalog 50. *You pay no more for*

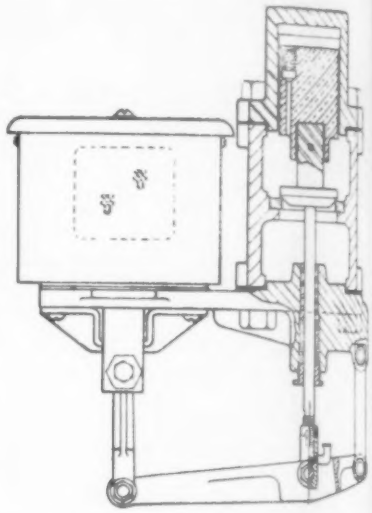
LONGER TOOL LIFE
CLOSER ACCURACY
SUPERIOR FINISH

GROUND L&I Reamers

LAVALLEE & IDE, INC. • CHICOPEE, MASS.

Dash-Pot Valve

The Johnson Corporation, Three Rivers, Mich., has developed Series No. 400 Solenoid Valve which features a dash pot to eliminate the water hammer that can result from the sudden closing of a valve in a high velocity pipe line. This special dash pot design is now available in the Johnson line of direct operated solenoid valves. Designed for normally closed operation, it slows down the closing action of the valve 1½ to 2 seconds.



As shown by the line drawing, the dash pot construction consists of a bronze piston fitted within the top housing of the valve, and pinned to the valve to follow its movement. An upward seating ball check controls the flow through a port in this piston. When valve is opened, and piston moves up, liquid above piston flows freely through the port so there is no resistance to the instant opening of valve orifice.

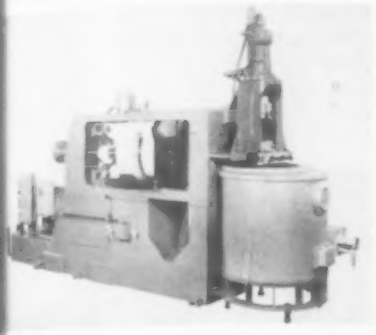
When valve closes, however, the ball check closes the port; liquid must then flow between the piston and the housing, a restricted passage which slows the closing of the valve. Piston and valve are independent of the action of the valve-opening push rod. T-3-37

Scale for Sketching

Rapidesign, Inc., Box 592, Glendale, Calif., announces the addition of the No. 20 sketch scale, a transparent pocket rule made of 0.030 in. matte finish mathematical quality plastic. Scaled in 10ths and 16ths, with cut-outs for making field sketches and other drawings it may be regarded as a non-technical instrument of technical quality. T-3-38

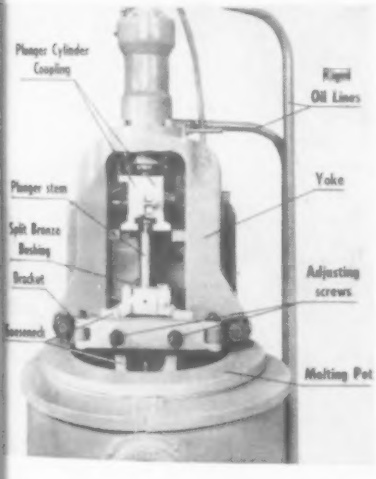
Die Casting Machine for Zinc

The HP-1-Z Zinc Die Casting Machine, by Lester-Phoenix, Inc., 2711 Church Avenue, Cleveland, Ohio, has been specifically designed to meet the needs of the zinc die caster. As far as possible it has also been designed to eliminate the human element in setting up and adjusting the machine.



The gooseneck of the HP-1-Z locates itself in two machined slots in the yoke. Fixed to the gooseneck is a split bronze bushing which guides the plunger stem. The head of the plunger is held by a T-slot coupling attached to the plunger cylinder, making the plunger completely self-aligning.

As claimed by the maker, this construction cancels out the possibility of misalignment of these components. The only adjustment is with two dog-point screws against the bracket, seating the gooseneck firmly against the nozzle, making the whole installation simpler than setting up dies. **T-3-39**



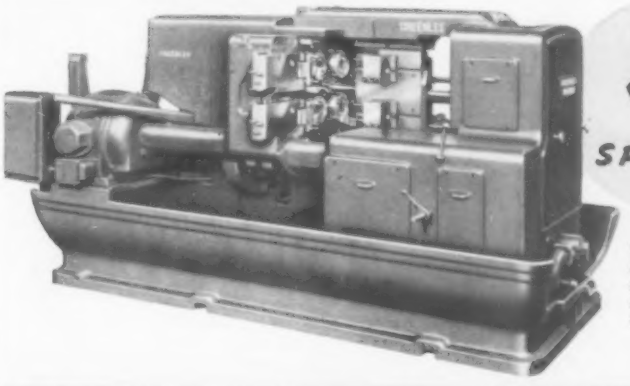
Another feature of the machine is that the pot can be made any size desired, since it is entirely separate from the structure of the machine itself. Furthermore, the plunger cylinder yoke is no longer subject to any adjustment, being rigidly mounted on the frame of the machine. The oil lines to and from the plunger cylinder are permanent, rigid pipe lines, rather that hose. They are therefore considerably safer. **T-3-40**

See Page 70 For Handy Tools Of Today Coupon

Magnetic Counter

A Magnetic Counter, by Abrams Instrument Corporation, Lansing 1, Mich., is a small unit primarily designed for installation in limited space. A 3 or 4-digit precision counter adaptable to wide industrial use, the additive or subtractive counter wheels record a maximum of 1200 counts per minute.

Actuated through electro-magnets, the counters can be connected in vacuum tube plate circuits, or may be operated by a contacting device. Each wheel can be reset manually, and figures are either white or fluorescent or black. The instrument measures about 1 x 2 in., weighs 2 ounces and is available in 24 or 110 volt AC or DC coils. **T-3-41**



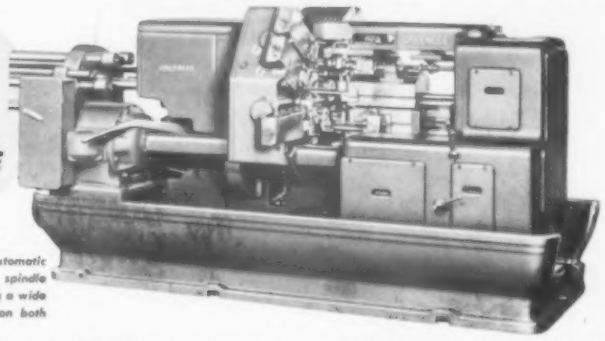
4 SPINDLE

THE GREENLEE "FOUR"
A heavy-duty automatic made in 1⅝" and 2½" spindle capacities. The "Four" incorporates all the cost-cutting features of the well-known "Six" (see below).

GREENLEE

AUTOMATIC SCREW MACHINES

6 SPINDLE



THE GREENLEE "SIX"
A ruggedly-built, high-speed automatic . . . available in 1", 1⅝", and 2" spindle capacities . . . capable of handling a wide range of work . . . widely used on both short and long-run jobs.

OUTSTANDING FEATURES OF ALL GREENLEE AUTOMATICS

Write for literature describing in detail all the features of Greenlee Automatics.

PRODUCTION MACHINERY GREENLEE

UNIVERSAL TOOLING — Tool holders fit any cross-slide cavity . . . are easily and quickly changed . . . reduce equipment costs.

INTERCHANGEABLE CAMS — Can be changed at will without re-adjustment of tools and holders. Cam storage is held to a minimum . . . cam costs greatly reduced.

BUILT-IN THREADING DRIVE AND FEED — Not an extra attachment, but standard equipment on Greenlee Automatics.

BUILT-IN COOLANT SYSTEM — Eliminates cumbersome piping in tooling area . . . gets coolant right where it does the most good.

LARGE TOOLING AREA — Permits using many timesaving, cost-cutting auxiliaries that often eliminate second operations.

Various special adaptions of standard Greenlee Automatics can be made . . . for handling second-operation work . . . for tooling extra-long work pieces . . . for multiple feed-out arrangements, etc.

Send us details of your work. Let our engineers show you how profitably Greenlee Automatics can be applied to your production.

GREENLEE BROS. & CO. 1983 Mason Ave., Rockford, Ill.

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

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Auburndale 66, Mass.

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Cinrock Machinery, Inc.
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PHILADELPHIA
Hepworth Machine Tool Co.
2311-17 North 16th St.
Philadelphia 32, Pa.

HOUSTON
C. J. Harter Machinery
3838 Navigation Blvd.
Houston, Texas

HARTFORD
Frank A. Parker
30 Farmington Ave.
Hartford, Conn.

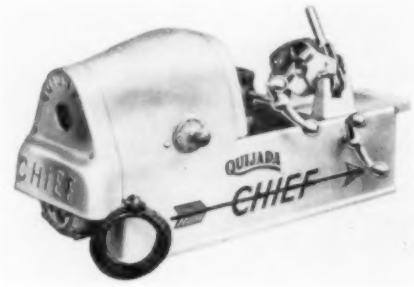
SEATTLE
Dawson Machinery Co.
5700-4 First Ave., South
Seattle 8, Washington

ST. PAUL
Sales Service Machine Tool Co.
2363 University Ave.
St. Paul 4, Minn.

DALLAS
C. J. Harter Machinery
1501 Gulf States Bldg.
Dallas, Texas

"Chief" Pipe Threader

The Quijada Tool Co., 5474 Alhambra Ave., Los Angeles 32, Calif., announces the "Quijada Chief", a ½ to 2 in. portable pipe and bolt threader. This tool features 4 jaws, front, that automatically grip the pipe, and 4 jaws, rear, that automatically center the pipe even on the smaller sizes. Chucks are operated automatically through a push-pull switch.

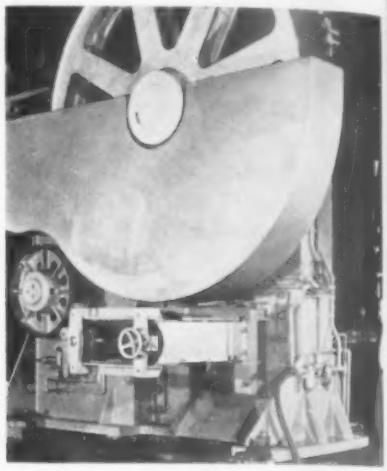


Cutting oil is transmitted from the oil pump through telescoping oil lines directly onto cutting surfaces. The tool utilizes a die head for each size of pipe, and a reamer, attached to each head, reams while threading. When the proper length of thread is cut, a bell rings, notifying operator to open die head. The cutter assembly is mounted conveniently for cutting off immediately after making up fittings. T-3-42

700-Ton Shear

Shown set up prior to shipment is a 700-ton Billet Shear with a specially designed retracting gage, to simplify its operation, which has been built by the Bethlehem, Pa., plant of Bethlehem Steel Company for one of the larger automobile manufacturers.

Billets are fed in continuously, by automatic conveyor, to one side of the machine. They emerge as slugs on the other side, tumble down a chute and, under everyday working conditions, fall into a buggy. For this purpose, the shear will be erected on a foundation several feet above floor level.



The shear is said to cut mild steel billets up to 6 in. square and 105,000 tensile steel billets up to 4 inches. Two 3-inch high tensile steel billets can be cut at once. From the slugs, such miscellaneous drop forgings as ring gears, crankshafts and steering knuckles will be made.

A hinged gage swings out of the way so that workmen can easily get at the shear blade. Through synchronization, the gage also retracts before the blade cuts, letting the slug drop freely.

With the aid of a long and a short peel, the gage measures either short or long lengths without requiring an awkwardly long gage. It permits the cutting of slugs from 3 to 38 inches long, making adjustments to 0.008 inch. The hand wheel shown at lower center adjusts the gage. T-3-43

High-Pressure Cylinders

The Northern Tool & Machine Co., Melrose Park, Ill., has announced a line of single and/or double action high pressure Hydraulic Cylinders available to equipment manufacturers. Designed for working pressures of 4,000 psi, in a range from 5 to 60 tons, the cylinders are all steel with hard chrome finished moving parts. Dual seals are used at all points to assure long life.

Because the cylinders are designed for higher pressures, the manufacturer states that they permit more consolidated and compact piping arrangements. In addition to their high pressure cylinders, the company supplies high pressure valves and pumps to provide a complete hydraulic system for other equipment. T-3-44

"ECLIPSE Eclipse QUALITY"

WHAT IT MEANS IN TERMS OF EFFICIENCY AND PROFIT for You!

1. DESIGN SERVICE. Eclipse engineers will design your cutters directly from part print. Your engineers will have more time to devote to other tool problems.

2. MAXIMUM LIFE. Eclipse engineering with 35 years experience behind it, assures cutter designs to give maximum life with minimum down time.

3. MULTIPLE OPERATIONS. Eclipse originated and developed multi-diameter cutters and its engineers are best qualified to design cutters to perform maximum operations at a single pass.

4. ASSURED QUALITY. Produced in the modern Eclipse plant with latest type equipment where quality is paramount and inspection rigid.

CUTTERS: H.S.S. and Tungsten Carbide Tipped—Multi-diameter—Inserted Blade—Center Cutting—Inverted and Down Drive—Double End Facers—End-Form—two piece Core Drills.

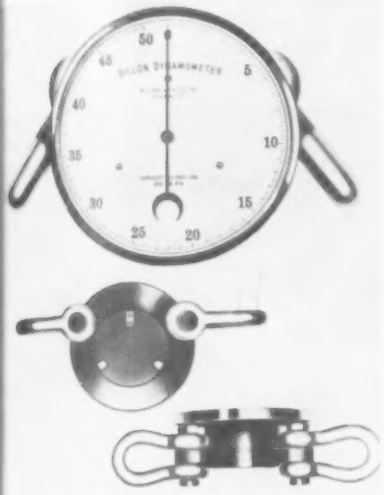
HOLDERS: Stop Collar—Bushing Guided—Adjustable length—Floating—Specials of all kinds.

Also complete stock of Standard Holders, Cutters and Pilots.

ECLIPSE COUNTERBORE CO.
Founded over thirty five years ago
DETROIT 20, MICHIGAN

Traction Dynamometers

Illustrated is a 50,000 lb. capacity traction-type Dynamometer, one of several of these high capacity testing devices by W. C. Dillon and Co., Inc., 5410 W. Harrison St., Chicago 44, Ill. Others in this group range 30,000 and 40,000 lbs. capacity.



These units are used to check drawbar pull, weight of bulky objects, static loads and tension in ropes or cables. Dial diameter is 10 in., as compared to about 5½ in. for the smaller AN models, and provides easier reading and a finer increment breakdown. **T-3-45**

Enclosed Instrument Panels

Claude S. Gordon Company, 3000 So. Wallace St., Chicago 16, Ill., announces a line of totally enclosed Instrument Panels. Wired and ready for connecting power and thermocouple leads, they are complete with pilot light and push-button controls.

Shown is the front of a panel with a pyrometer controller and the Xactline "Straight-line" control in place. The panels are available in two sizes—19x15x7 in. deep, and 21x21x9 in. deep. Made of 16 ga. steel and finished in black enamel. **T-3-46**

See page 70 for handy Tools of Today coupon.

Fluorescent Magnifiers

Industrial Products Company, 3134 N. Fourth St., Philadelphia 33, Pa., announces two Industrial Magnifiers, equipped with fluorescent lighting and designed for assembly workers, inspectors, toolmakers, machinists and others engaged in close work. The instrument floodlights the work area with shadow-free fluorescent light, magnifying the work through a high quality 5 in. diameter lens.

The bench type shown has a steel base, two adjustable friction arms and two swivels to provide adjustment to any desired position. The portable type is similar to the bench model except that, fitted with a comfortable hardwood handle, it is practical for use inside of machines and in other out of the way places. Furnished complete to plug into any 110-120 volt, 60 cycle circuit. **T-3-47**

All Standard Accessories Ready to Go Immediately
DETROIT DIE SET CORPORATION immediately on receipt of order ships all standard items in a wide range of sizes . . . dowel pins, die springs, stripper bolts, socket grip head cap screws and other accessories. All are nationally known products manufactured with the same precision as "DETROIT" die sets. For dependable shipment, 'phone, wire or write "DETROIT."
CALL "DETROIT"
DETROIT . . . . TR 2-5150
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DAYTON . . . . HE 3042
INDIANAPOLIS . . HU 5604
LOS ANGELES . . AD 7251
MILWAUKEE . . ED 2-2359
MINNEAPOLIS . . AT 5264
PHILADELPHIA . . VI 4-4084
PITTSBURGH . Perrysville 3203
PORTLAND . . . WE 3254
ROCK ISLAND, ILL. . 8-2814
ST. LOUIS . . . FR 6810
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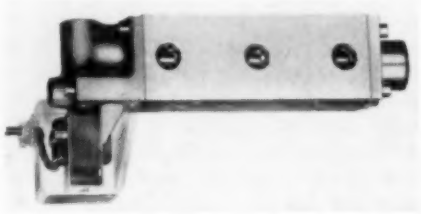
DETROIT DIE SET CORPORATION
2895 W. GRAND BLVD. • DETROIT 2, MICH.
DETROIT DIE SET ★

Solenoid Valve

Type "SA", added to the line of Quick-As-a-Wink valves by C. B. Hunt & Son, Inc., Salem, Ohio, employs a small solenoid to move a small pilot valve plunger to apply air to the operating piston which, in turn, runs the main valve plunger.



When the solenoid—which travels through only a ⅛ in. stroke—is de-energized the pilot cylinder is exhausted through the small pilot valve. This permits the main plunger to return due to the bucking cylinder pressure on the opposite end.

The design is said to assure positive performance and a much greater operating force than is possible with a large direct-connected solenoid. The valve may be operated with standard types of pilot switches without intermediate relays, and may be operated at the high speeds required for production welders and other high-cycle requirements. **T-3-48**

This is another of the "HUNDREDS OF JOBS" which can be done on a MARVEL Band Saw!

MARVEL BAND SAW saved these two 4400 lb. castings

Two sand cores washed out when these giant 4400 pound steel connecting rods were cast, resulting in solid eye ends without gaps. Then came the $64 question— how to machine out the 1½" slots in the longitudinal center of the eyes which were 22" high and had a wall thickness of 6½".

The Ernest J. Nelson Iron Works of San Francisco, did this "impossible" job easily, quickly and economically, without special tooling, on a standard Model No. 8M/2 MARVEL Band Saw. Two cuts were made in each rod in two hours per cut with tool cost of $3.06 per rod. The tool was a MARVEL B9-10 Band Saw Blade.

Every tool room, machine shop and maintenance department needs a MARVEL Series 8 Universal Band Saw—not only for innumerable everyday jobs but for the occasional "trick" operations, where its utmost versatility will save many headaches and dollars.

WRITE FOR CATALOG

These exclusive MARVEL features made this job easy:

1. Large, T-slotted work table.
2. Blade feeds into work vertically; work always stationary.
3. Power-pressure feed.
4. Automatic blade tension.
5. Built-in coolant system.
6. Large capacity.

MARVEL Metal Cutting SAWS — Better Machines-Better Blades

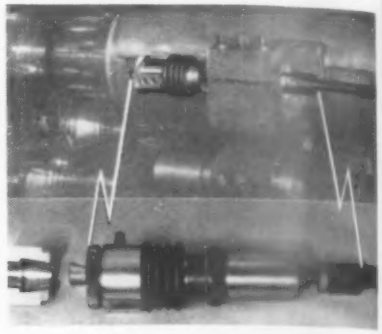
See our CATALOG in SWEET'S FILE

ARMSTRONG-BLUM MFG. CO.

5700 Bloomingdale Ave., Chicago 39, Illinois

Internal Forming Tool

The Maxwell Company, 250 Broadway, Bedford, Ohio announces an Internal Forming Tool designed for use on fully automatic machines to facilitate production operations on jobs formerly requiring secondary set-up. Designated series "DB", these forming tools are recommended for use in back counterboring, thread relieving, grind relieving, back chamfering, and ordinary recessing operations.



Quickly set up, series "DB" tools can be used in any position and can further be interchanged between different machines on which internal forming operations are to be performed. Provisions have been made for accurate adjustment for location and diameter of recess.

The tools are available for immediate delivery in three standard sizes: Model No. 1½ tool with working range from ⅜ to 2 in.; No. 2 with working range from 1 to 3 in., and Model No. 3 with range from 2 to 4 in. In all cases, the tool size indicates the shank size.

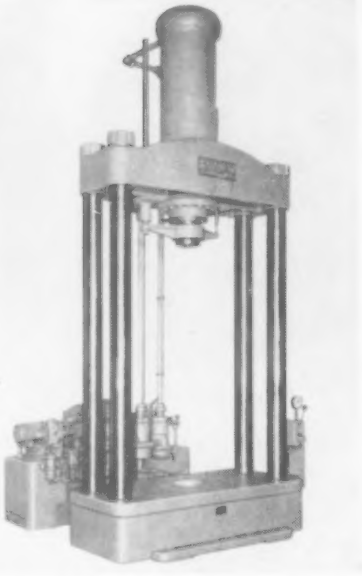
Additional features of "DB" tools include ball bearing type pilot—located on the front of holder—for operations involving close concentric and diameter tolerances, or when it is desirable to pilot tool into and stop on face of workpiece; standard feed ratio of approximately 1 to 3—or as specified—and the utilization of comparatively inexpensive circular form cutters or cutters with inserted bits, either high-speed or carbide tipped. In addition, series "DB" tools incorporate a tool block which is positionable in relation to the diameter of the cut to be accomplished. **T-3-49**

Lubricant Meter

A Measuring Device for filling automotive transmissions with lubricant on an assembly line is manufactured by the J. N. Fauver Co., Inc., 49 West Hancock, Detroit 1, Mich. The device consists of a 4-way operating valve and hydraulic cylinder mounted on a fabricated frame and piped so that when the valve is in the one position, the cylinder is operated in one direction to measure a specific volume to the transmission. When the valve is reversed, the cylinder is actuated in the other direction, measuring the same amount in another transmission. The amount of lubricant is adjustable. A check valve prevents dripping. T-3-50

Forcing Press

Unusual ram speed for a 150-ton press—a maximum of 275 inches per minute—is claimed for a 4-post hydraulic Forcing Press announced by Hannifin Corporation, 1120 So. Kilbourn Ave., Chicago 24, Ill. The unit shown, which is used primarily for the press-fit assembly of shafts to armatures and rotors, has an 82 in. gap, ram up, and a 48 in. maximum stroke.



Distance between columns is 60 inches left to right, and 10 inches front to back. The table, which is 36 inches deep front to back, is 18 in. above the floor and has a 10 in. hole in its center to allow shafts to extend through. The ram is guided to prevent rotation if a fixture is used.

The unit incorporates the Hannifin sensitive pressure control, which allows the operator to vary the amount of pressure applied by the amount he moves the single hand lever. When a uniform pressure is to be applied repetitively, a stop is provided to limit the travel of this control lever. The predetermined pressure thus obtained can be varied all the way from 15 tons to full 150-ton capacity. **T-3-51**

Vacuum Chuck

A Vacuum Chuck, by O. S. Walker Company, Inc., Worcester, Mass., is designed to meet special requirements of the aircraft and glass industries, as well as other industries engaged in processing non-ferrous materials.

The chuck may further be used in the electrical industries for holding insulating materials, plastics and rubber materials, thick as well as thin. The chucks are furnished in a full range of sizes comparing with electro-magnetic chucks. **T-3-52**

FIGURING TOOL COSTS ON PERFORMANCE ... NOT PRICE, PAYS BIG DIVIDENDS

Productivity—not pennies—is the only way to judge the cost of a tool. No tool deserves a place in your shop unless it can prove . . . on the job . . . that it will enable the machine to operate at peak performance, with minimum downtime.

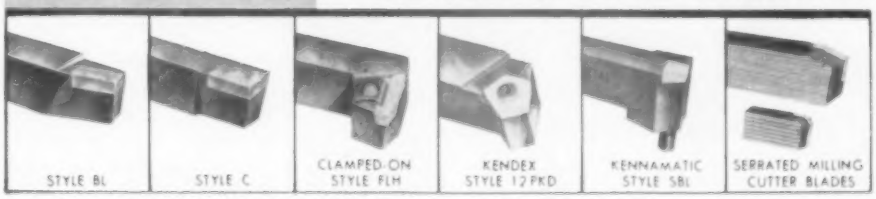
Kennametal cemented carbide tools are made by processes that are exclusive and expensive, but which are worth far more than the cost . . . because they assure a tool material of consistent soundness.

This Kennametal characteristic pays off—in your shop. In many instances, Kennametal tools will pay for themselves in savings effected in grinding, alone. And this does not take into account reduced tooling costs, and improved production rates attained.

We'll send you, on request, reports that show cost reductions of thousands of dollars on many different operations through the use of Kennametal tooling. But—there is a much better way to demonstrate. That's in your shop, on your job. Ask us to do it.

KENNAMETAL Inc., LATROBE, PA.

MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES AND CUTTING TOOLS THAT INCREASE PRODUCTIVITY



Finest for SPEED: Taps more quality threads per hour, more holes than any other tapping attachment.
Finest for ACCURACY: Attaches firmly to drill press or tapping device.
Finest for VERSATILITY: Taps anything from soap to nickel steel without pressure on tap—prolongs tap life.
Finest for ADAPTABILITY: Five sizes, standard or built-in models, will fit any drill press or tapping device. 0-1½" cap.
Finest for MAINTENANCE: Requires little or no maintenance.
TORQOMATICS, when used with Jarvis TECNI-TAPS, make the finest possible combination for low-cost, high-quality tapping. Send for free, illustrated, descriptive literature to The Charles L. Jarvis Company, Middletown, Conn.

Jarvis POWER TOOLS

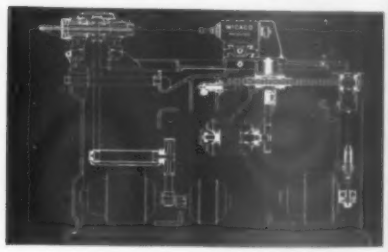
TAPPING ATTACHMENTS
TECNI-TAPS and DIES
ROTARY FILES
FLEXIBLE SHAFTS and MACHINES
QUICK CHANGE CHUCKS and COLLETS

THE CHARLES L. JARVIS CO., MIDDLETOWN IN CONNECTICUT

Internal Grinder

A precision Internal Grinder, by the Wicaco Machine Corp., 4802 Stenton Ave., Philadelphia 4, Pa., incorporates a number of novel features that greatly adds to performance and maintained accuracy. All concealed units are mounted on hinged doors for ready inspection, and revolving parts are corrected for dynamic balance. Coolant tank and pump are integral and mounted on the back face of the bed.

The motors, hung on the doors, drive workhead and carriage from a position directly beneath them. The wheel drive motor is hung under the center of the carriage so that the bed ways absorb most of the torque. By reducing vibration, this installation also promotes extreme accuracy, which is further enhanced by rigidly built work-head and carriage.



The carriage is driven by a variable speed motor with rheostat control, providing 16 speed variations with traverse movement 0.001 in. The automatic reversing device will automatically reverse the carriage without damage to machine in event of obstruction between moving and fixed parts of machine. However, construction details can best be judged from the schematic drawing which, better than words, is indicative of the general clean design.

T-3-53

"Ring-Seat" Center Drill

The "Ring-Seat" center drill by Link Industries, 13840 Elmira, Detroit 27, Mich., is said to have several times the life of ordinary center drills.

Due to a unique torque-curve contour, there is no angular fatigue point between the tip section and the center forming section; also, the tip diameter is slightly larger than the body of the tip-section, providing clearance behind the tip.

T-3-54

Measuring Microscope

The Boeckler Instrument Co., 31 E. Pillito St., Tucson, Ariz., has entered the low-priced instrument field with the Toolmaker Microscope, designed to perform all functions of linear, coordinate and angular measurements. Range of measurement is 6½ in., and a workpiece can be surveyed in coordinates up to 6½ x 6½ in.

The micrometer head is novel in that a non-rotating spindle is used; therefore, there is no wear in its action against stage or gage rods. Also unusual is the 20 pitch lead screw, which offers two advantages: The action is fast, and there is greater ease in reading as the thimble is graduated in 50 divisions, each denoting 0.001 in.

The scope stage is fitted with railings, at 90 deg to each other, against which the workpiece can be placed. Accordingly, after rotation of the work 90 deg against the second railing, second coordinate measurements are made. Angular measurement is made by linear determination plus shop trigonometry. A protractor eyepiece can be fitted as extra equipment.

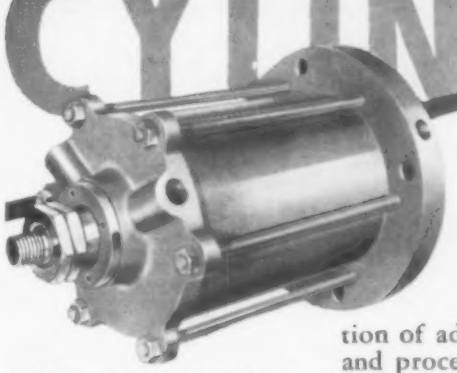
The optical elements and microscope tube are of highest quality. The eyepiece is Ramsdell type and overall magnification is about 32X. Illumination is adequate for magnification used and it's adjustable for shadowless lighting of object. **T-3-55**

Rough Cored Die Nibs

Tungsten Alloy Manufacturing Co., Inc., Newark, N. J. has added rough cored uncased Die Nibs, for collapsible tube dies, to its line of standard tungsten carbide items. Tungsten carbide dies for drawing these tubes are rapidly getting broad acceptance among the tube manufacturing companies, and in many instances tungsten carbide punches are also being used successfully in collapsible tube manufacture.

Tungsten Alloy will initially stock eight sizes of these die nibs, ranging from ⅝ to 1½ in. I.D., and in the various grades of tungsten carbide best suited to the metal for which the dies are to be used. It is anticipated that punch nibs in the equivalent sizes will eventually be added to the standard items stocked. **T-3-56**

CYLINDERS



Continuous specialization since 1905 in the design and manufacture of cylinders has resulted in Hannifin leadership in the development of improved designs, use of better materials, and introduction of advanced manufacturing methods and processes. Collectively, Hannifin cylinders have chalked up literally hundreds of thousands of service years of experience covering almost every conceivable type of application. You are not experimenting when you specify Hannifin cylinders!

AIR CYLINDERS

- 10 standard bore diameters, 1" to 12".
- Any length stroke. Double acting or single acting.
- 6 basic mounting styles with many double end rod and combination styles.
- Adjustable cushions for head end, rod end, or both.
- Your choice of Series "LW" cup type or Series "R" externally adjustable "Leakproof" piston construction.
- Many special sizes, types available.

HANNIFIN Sets the Standard for QUALITY!

HYDRAULIC CYLINDERS

- 12 standard bore diameters, 1" to 8".
- Any length stroke you specify.
- 11 standard mounting styles, plus many combination styles.
- Standard, double end, or heavy duty (2:1) piston rods.
- Adjustable cushions for head end, rod end, or both.
- Special sizes, types built to order.

There are easier, cheaper ways to build cylinders—*but not to Hannifin's standards for quality!* Every Hannifin cylinder is "TRU-BORED" (specially trued axially, laterally, and for roundness), then honed to a laboratory-controlled internal finish by exclusive Hannifin methods. Hannifin packings and seals are selected only after exhaustive tests. Hannifin designs and Hannifin's precision manufacturing processes insure complete interchangeability of parts. You assure yourself of unquestioned performance when you standardize on Hannifin!

Engineering Recommendations

Let Hannifin engineers help you get the BEST solution for your cylinder problems. See your local factory-trained Hannifin field representative today. Ask for copies of the helpful bulletins illustrated at the right:

Bulletin 110 "HANNIFIN HYDRAULIC CYLINDERS"
Bulletin 210 "HANNIFIN PNEUMATIC CYLINDERS"
SEND FOR YOUR COPIES TODAY!

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AMES
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give impersonal, accurate results

FASTER

When you want to measure the thickness of either hard or resilient sheet materials you'll find one of these Ames Dial Comparators best for the job.

Ames No. 2 Dial Comparator is used for measuring non-yielding materials — sheet metal — hard rubber — glass. Compact and steady, it is ideal for bench use. The 2" dia. table is adjustable to bring pointer to zero. Fingertip lever raises contact for rapid insertion of pieces. Release lever and read dial for a truly impersonal and accurate result.

Representatives in principal cities. B. C. AMES CO. *30 Ames Street Waltham 54, Mass.*
Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

Ames No. 2W Comparator is similar to the Ames No. 2 but is fitted with a dead weight for standard measuring of resilient materials — sheet rubber — paper — plastics — etc.

Both gauges are available with dial graduations in .001", .0005", .0001" and .01 mm. Write for full details.

Ball Turning Rest

Marking recent engineering development in lathe accessories, a Ball Turning Rest of improved design said to contribute to more efficient performance and smoother operation of Monarch 14, 16 and 20 in. Series 60 engine and toolmaker's lathes is announced by the Monarch Machine Tool Company, Sidney, Ohio. The design is said to simplify setup considerably as compared with the difficulties frequently encountered with previous designs. Also, its application to the machine is a simple, quick procedure.

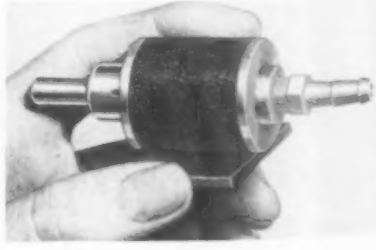
The regular bottom slide may be positioned either on center, for ball turning or boring, or out-of-alignment with the spindle center for spherical radius turning. A micrometer dial is provided to adjust the bottom slide in or out. Diameter of the ball or radius being turned also can be controlled accurately by means of a similar micrometer adjustment.

With this accessory, a 4 in. diameter ball can be turned on the 14 in. Monarch Series 60 engine or toolmaker's lathe, a 5¾ in. diameter ball on the 16 in. machine, and a 6 in. diameter ball on the 20 in. unit. When equipped with a 1 in. raise, the 16 in. lathe is capable of turning a 7⅝ in. diameter ball.

Boring a socket is also performed effectively as a result of this basic improvement in ball turning rest design. Maximum size which can be handled is 4 in. on the 14 in. and 16 in. machines, and 6 in. on the 20 in. unit. On some classes of work, concave spherical surfaces with larger radii—up to as much as 12-in.—can be machined. T-3-37

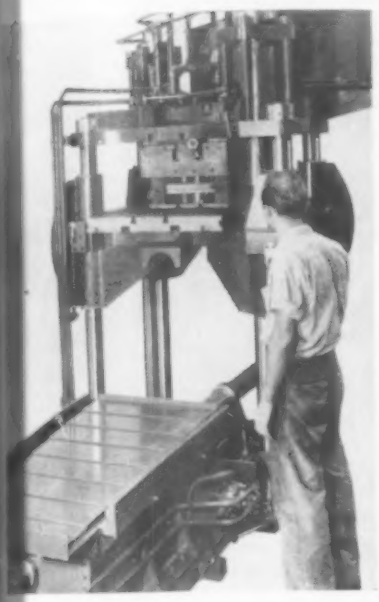
"Micro" Air Cylinder

Air-Mite, 2651 W. Lake St., Chicago 12, Ill., has added Micro Model Cylinders for use in small jigs and fixtures where size and space limitations are primary factors. Despite their small size, these "pint-size" air cylinders are said to deliver 75 pounds thrust on a 100 pound line pressure. The stroke is ⅝ in., with equal ram pressure at any stroke point. T-3-38



Die Testing Machine

Lester Engineering Company, 2711 Church Avenue, Cleveland 13, Ohio, announces a Die Testing machine said to open and close dies with such accuracy that the parting line can be matched perfectly before the die leaves the tool room.



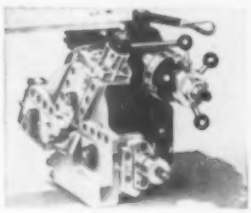
The machine operates as follows: The two halves of the die are clamped to the two machine platens. The bottom platen moves down and then moves out horizontally. The die is then at a convenient height and out in the open so that it can be easily reached and worked on. It can then be quickly moved in and up, in perfect alignment for checking.

Engineering-wise, the machine is unique in that the oil cylinders are located inside of two of the vertical columns. The bottom plate is the movable one—yet there is no need for a pit to accommodate an oil cylinder. Though the vertical travel is 36 in., the machine will fit under a 10 ft. ceiling. **T-3-59**

Cloth Reproducing

The conventional negative step used in making cloth reproductions of engineering drawings is said to be eliminated by the use of Kodagraph Autopositive Cloth, a photosensitized cloth developed by the Eastman Kodak Company, Rochester 4, N. Y. Like other "Autopositive" materials, this cloth produces a positive copy directly from a positive original drawing. It may be handled in normal room light and is exposed on conventional blueprint or direct-process machines or a vacuum printing frame.

Not only does elimination of the negative result in savings in time and materials; it also produces a cloth reproduction free from the distortion introduced by the use of paper negatives. The cloth is highly translucent, assuring rapid production of quality shop prints, and may be drawn in on either side, using ink or pencil. **T-3-60**



This leading machine tool manufacturer uses Allen Head screws by the hundreds of thousands for compact design, assured holding power and maintenance of precision adjustments.

The only place to use a cheap screw is when you don't care if it holds or not. Usually shearing or loosening costs thousands of times what you "save" on the cheapest fasteners.

You pay no premium for *genuine* Allen Head screws—only enough to *assure* uniform strength and Class 3 fit.

Allen gives you the toughness of Allenoy steels, 100% Pressur-forming, the advantage of every proved threading method, quality control at every step, including automatic instrument controlled atmosphere heat treating.

SOLD ONLY THROUGH LEADING DISTRIBUTORS

Write the factory direct for technical information and descriptive literature.

WARNING
Allen-Type screws aren't necessarily Allen-Made.
Get genuine Pressur-Formed Allen Head screws in this black and silver box.

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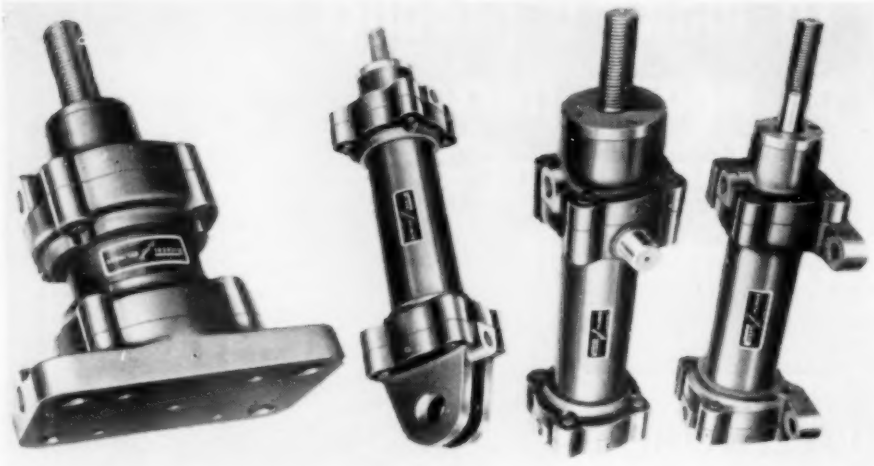
MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.
NEW YORK, CLEVELAND, DETROIT, CHICAGO, LOS ANGELES

Hydraulic Cylinders: By Vickers



An extensive line of hydraulic cylinders for industrial service, announced by Vickers, Inc., 1416 Oakman Boulevard, Detroit, Mich., features improved cylinder head seals, multiple piping connection positions, universal mounting positions, special self-adjusting packings, and adjustable hydraulic cushions. Design of this cylinder line also follows practice recommended by JIC Hydraulic Standards for Industrial Equipment.

The Vickers Series LA Hydraulic (Oil) Cylinders are available in 12 standard bores from 1 to 8 in., and 12 standard mounting arrangements, with innumerable combinations possible. Nearly all models can be optionally equipped with either standard or heavy duty rods.

Illustrated are typical Vickers cylinders for foot, flange and clevis mounting. A characteristic of this line, which is fully described in Vickers Bulletin 49-55, is nicety of design and workmanship and the extreme care taken with even minor details to assure the utmost of performance and long life. Enquiries addressed to the company should be referred to Mr. R. E. Esch, Manager Industrial Sales Division.

T-3-61

2 COMPLETE LINES HELP SOLVE DIE DESIGN PROBLEMS
Save with...
DANLY
DIE SPRINGS
Why compromise when you can specify die springs that meet your individual requirements more exactly? Danly's two complete lines double your range of selection for any given application. Any standard size is available in either medium or heavy duty types. All Danly Die Springs are precision coiled from the finest fatigue resistant steel and ground square on both ends to assure full end bearing. Start selecting your die springs to fit the job . . . specify DANLY DIE SPRINGS!
Write today for our special size and price folder giving detailed information on Danly Die Springs and Danly Dowel Pins.
DANLY MACHINE SPECIALTIES, INC.
2100 SOUTH 52ND AVENUE, CHICAGO 50, ILLINOIS

"Truforming" Grinders

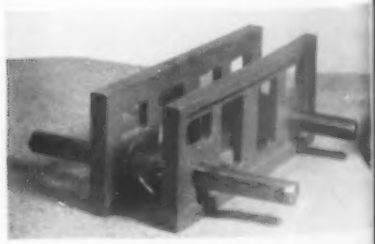
A Truforming Contour Grinder, recently developed by the Thompson Grinder Company, Springfield, Ohio, is said to reduce grinding time on 8 in. circular wood saws to 2½ minutes as compared to 2 operations and 8 to 10 minutes to complete a similar saw on a circular single chuck grinder.

In the Thompson machine, the grinding wheel covers the entire saw area to be shallow-tapered and both grinding wheel and saw rotate in the grinding process. Thus, the outer edge of the saw is ground to 0.086 in. and in a one inch taper to 0.058 in. and then to 0.069 in. at a distance of 1⅝ in. from the center. For circular wood saws, Thompson "Truform" Grinders are available in 6 to 12 in. and 6 to 16 in. sizes.

Crushing, trueing and working cycles of operation are automatic, with fully automatic push button control. The machines are compact, with centralized control for easy operation. T-3-62

Adjustable Parallels

Adjustable Parallels, by Tinker's Thread Grinder Company, 136 Granby Road, So. Hadley Falls, Mass., are adjustable sideways to provide "stay-put" spacing between mating units. They are always in pairs—no lost time looking for a mating parallel.

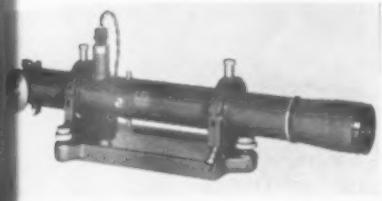


Openings in the parallels, which can be used for drilling, milling, shaping, bench work and other operations, provide for clamping to machine tables. Height also provides room for guide pins and shanks of die sets between machine table and top of parallels.

Available in heights 4 and 6 in., lengths 10, 12 and 18 in., adjustable from 3¼ to 11¼ up to 4 to 20 inches. Fully described in a bulletin. T-3-63

18-Inch Auto-Collimator

The Watts 18-in. Auto-Collimator now introduces methods successfully employed in the optical industries to the machine tool and general engineering field. The instrument produces a beam of parallel — collimated — rays of light and is said to measure to the accuracy of ½ second of arc any deviation between the original direction of the beam and its reflection by a mirror or polished surface.

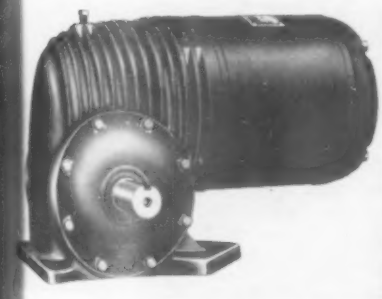


As claimed by the maker, it is possible to produce a chart showing waviness in a surface plate, machine bed or shaft, to an accuracy of better than .00004 in., and that with the use of simple accessories such as gage blocks, angle gage blocks, reflecting squares, or mirrors, a large number of extremely accurate angular measurements can be taken directly.

Linear measurements can be determined by simple computation without regard to distance and without wear, distortions due to temperature changes, or other factors normally affecting accuracy of measurement and inspection. The instrument, which is primarily designed to serve in the gage laboratory and tool room and in the shop when machining and assembling large units requiring accurate alignment, is distributed exclusively in the United States by Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **T-3-64**

Century Gear Motor

A 1½ HP Gear Motor, by Century Electric Company, Gear Motor Division, 806 Pine St., St. Louis 3, Mo., extends the present Century line from 1/8 to 1½ HP. Larger ratings up to 400 HP are available with gear attachments, for operation on single or polyphase AC or DC current.



The stated range of speeds that may be obtained in these motors are from 25 to 280 rpm. As additional features, there are only two moving parts—the armature shaft and the output shaft; gears of rugged "worm type", and only four bearings—two ball and two roller. **T-3-65**

WENDT-SONIS

4 Point Plan

TO CUT REAMING COSTS!

1 LESS TOOL COST! W-S complete line of carbide reamers covers over 90% of reaming jobs. Reduced inventory!

2 GREATER ACCURACY! Precision tolerance as close as .0001. Lapped and protected grinding centers for more accurate resharpening.

3 BETTER FINISH! Grinding operations eliminated. All W-S reamers have diamond-lapped cutting edges and special hardened steel bodies stress-relieved before brazing.

4 IMPROVED DESIGN! New type of tool construction. Highly polished flutes with greater chip capacity.

Rely on the famous W-S complete line of carbide reamers — tried and proved for 15 years — to improve production at LOWER COST! Complete range of sizes . . . wide selection of styles . . . straight or taper shanks of hardened steel. Quick delivery on standard reamers with special diameters and tolerances. Make your next reamer order a W-S order . . . see your Wendt-Sonis distributor.

Free! NEW REAMING INSTRUCTION CHART

Determines speed and horsepower for cutting steel, ferrous, non-ferrous and non-metallic materials. Write today: WENDT-SONIS COMPANY, Hannibal, Missouri — 580 North Prairie Avenue, Hawthorne, Calif., 549 West Randolph, Chicago, Ill. Warehousing Facilities: Eastern Carbide Corp., 909 Main St., New Rochelle, N. Y.

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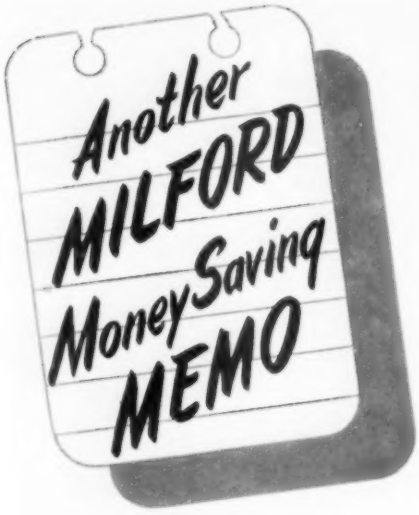
DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS
ROLLER TURNING TOOLS • SPECIAL BITS



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BLADE LIFE

Depend on the MILFORD Flexible REZISTOR to deliver its full cutting life without premature breakage — to last up to ten times longer than standard steel blades. The Flexible REZISTOR is shatter-proof — no flying fragments to injure the operator. Exclusive MILFORD Easy-Starting Teeth start the cut on the first stroke at any angle — prevent jamming by keeping the cut free and clear of chips. Teeth are as hard as those of any power blade; the back is tough and flexible. See your nearby MILFORD Distributor about Flexible REZISTORS today!

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Profile and Band Saw Blades — MILFORD — Rezistor & Duplex Hack Saw Blades

SOLD THROUGH SELECT INDUSTRIAL DISTRIBUTORS

North East West South IN INDUSTRY

E. C. Hughes, vice-president of **Bay State Abrasive Products Co.**, was elected president of the Grinding Wheel Institute at the organization's recent meeting in Atlantic City.

E. C. Hughes

George H. Hodapp

George H. Hodapp was named president of **Heller Brothers Co.** at a recent election by the company's board. Mr. Hodapp has extensive experience as an officer and executive with several companies.

Other officials named in the election included **James G. Henry, Jr.**, vice-president and secretary; **Miss Anna W. Ibach**, treasurer, and **Eugene M. Steenburgh**, assistant secretary.

A 61-part training course treating knowledge and use of industrial instruments has been added to the curriculum of **International Correspondence Schools.**

Rutland Tool Service, 13006 Greeley Ave., Detroit 3, has added a method of butt brazing unused ends of flat and dovetail form tools to its tool reconditioning services. In this way useless ends of straight form tools may be welded together to meet new specification.

Washington University's annual industrial control course will be given April 17-29. Classes will be offered in two sections covering general knowledge of methods and technical methods required of engineers to meet problems of specifications, production and inspection.

Carboloy Company, Inc., Detroit, has developed the idea of applying high tensile wire to form a "live-spiral" flute on the shank of a carbide masonry drill which automatically removes dust from the hole while drilling in masonry, brick, tile concrete and similar materials.

The Todd Co. has purchased patent rights to the Turnomat from **Karge & Son Machine Co.** The unit, a precision lathe and screw machine attachment for automatic turning, will be made at the Todd plant in Rochester, N. Y.

George L. Carr has resigned as vice-president and sales manager of the Apex Broach Co. and has accepted appointment as assistant to the sales manager of **Colonial Broach Co.** in charge of estimating.

The **Edward Blake Co.**, West Newton, Mass., has instituted a tap servicing department equipped for sharpening of taps with accuracy of thread, pitch diameter and rake angle of cutting teeth in order to renew and prolong usefulness of dull or broken taps.

J. M. Spangler has been appointed president of the **National Carbon Division of Union Carbide and Carbon Corp.** Mr. Spangler, who has been associated with the company for 35 years, formerly was director, vice-president and general manager of the Division.

The Euclid, Ohio, plant and equipment of Joy Manufacturing Co., Pittsburgh, has been purchased by the **Lewis Welding & Engineering Corp.** of Bedford, Ohio. The new plant will do machine work and machine assembly work at the **Breckenridge Machine Div.**, Lewis Welding & Engineering Corp.

Harry W. Davidson has been named secretary-treasurer, as well as member of the board of directors, of **Heppenstall Co., Pittsburgh.** Other recently elected members of the Heppenstall board of directors are **Robert C. Downie**, president, Peoples First National Bank & Trust Co., Pittsburgh, and **E. P. Hawkins** of Callaway Mills, Inc., New York.

Harry M. Reed recently was elected a director of **Vanadium-Alloys Steel Co.**, Latrobe, Pa. Mr. Reed who has been associated with the company since 1925, was elected its secretary in 1947.

Recent election made **Joseph A. Martino**, president of National Lead Co., a member of the board of directors of **Allegheny Ludlum Steel Corp.**

Also announced was the formation of **Titanium Metals Corporation of America**, owned jointly by the two companies, organized for the development and distribution of titanium metal, alloys and related products. Officers of the new company, with headquarters in New York City, are **H. C. Wildner**, president; **Clark W. King**, vice-president, and **A. H. Drewes**, secretary-treasurer.

Harry E. Masters has been appointed educational director in charge of all vocational education and industrial apprentice training programs and activities for **L. S. Starrett Co.** C. G. Nordmark now assumes the position of advertising manager vacated by Mr. Masters.

The **Carborundum Company** has begun production of Carborundum silicon carbide in its recently completed plant in Vancouver, Wash.

Manufacturing at the **O.K. Tool Co.** has ceased at Shelton, Conn., and will henceforth be conducted at Wilton, N. H., according to announcement from **Williams and Hussey** manufacturing company, recent purchasers of the organization. Key personnel, engineering and sales staff are remaining intact.

Electric heat in all its forms will be the subject of study at the four-day **Westinghouse-Edison Electric Institute Industrial Heating School**, starting March 13 at the Summit Hotel, Uniontown, Pa. The classes are for electric utility power sales engineers.

D. M. Berges has been appointed chief engineer, **Pesco Products Div., Borg-Warner Corp.** Mr. Berges, who has been associated with Pesco since 1943, formerly was chief engineer of the division's electrical section.

Frank Willmott, Chicago district sales manager of **E. W. Bliss Co.**, has retired after 24 years of service. **Bernard E. Meyer**, formerly sales engineer on special assignment, has been named to succeed Mr. Willmott.

The **Tocco Division** of **The Ohio Crankshaft Co.**, Cleveland are sponsoring a contest, prizes for which will be $1,000, $500 and $250 awarded for the best articles on "Economy In Production with Tocco Induction Heating". According to an official announcement, entries must describe a Tocco installation, actual or proposed, with illustrative photographs, and must be accompanied by an official entry blank. Judging will be by 12 editors of publications in the metal-working field.

Coming Meetings

Mar. 28-31, National Plastics Exposition, Navy Pier, Chicago.

Apr. 4-8, Cancelled, National Production Exposition, sponsored by Chicago Technical Societies Council.

Apr. 10-12, 5th annual convention, **American Society of Lubrication Engineers**, Hotel Statler, Detroit.

Apr. 10-14, Tool Engineer's Industrial Exposition, sponsored by the **American Society of Tool Engineers**, Convention Hall and Commercial Museum, Philadelphia.

Apr. 14-15, Ohio State Welding Engineering Conference, Ohio State University, Columbus.

Apr. 24-27, National Packaging Exposition, sponsored by the **American Management Association**, Navy Pier, Chicago.

Apr. 25-26, Annual Metal Powder Show, Book-Cadillac Hotel, Detroit.

May 8-19, British Industries Fair, London and Birmingham, England.

May 29-June 10, Canadian International Trade Fair, Toronto.

Never Before

SO MANY ADVANTAGES for HIGHEST PRODUCTION

Snow Full Universal Drilling, Tapping and Threading Machines are widely recognized, not for one or two high production features, but numerous ones—many exclusive. Consider advantages like these; Lower tool investment; small parts production often tripled; wider variety of work possible; less "down time"; air-operated, electrically controlled; simpler to operate; less operator fatigue; less operator skill required; accuracy of work unsurpassed. Submit sample parts and blue prints for quotation, production estimates and tooling data to learn how you can use Snow tools to increase your output and profits.

For Top Production

SNOW

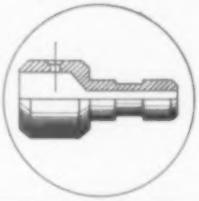
FULL UNIVERSAL MACHINES

Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING

Crossdrill and C'T" Sink 1/16" Hole

Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine



TAPPING

Tap Two #10-32 Holes

Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine

THREADING

3/8"—24 Thread—1/2" Long

Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine

Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and operation can be handled by a less experienced operator with minimum fatigue.

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435 Eastern Ave., Bellwood, Illinois
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Single Spindle Verticals • Two-Spindle Verticals • Two-Spindle Horizontals • Automatic Nut Tapping Machines • Drill Press Tap Heads • Automatic & Semi-Automatic Jigs & Fixtures

Submit Sample Parts for Production & Cost Estimates

Stuart's

ThredKuT

D. A. STUART'S THREDKUT straight, or in rich blend, provides fine finish on tough, stringy materials because its high sulphur content gives it excellent anti-weld characteristics.

In long dilutions THREDKUT delivers long tool life and outstanding performance at low cost on free cutting, high speed operations.

THREDKUT'S exceptionally broad range of usefulness makes it cost less than "cheaper" products in the majority of cases and often eliminates the need for several different types of oils. When it comes to *performance* on the jobs within its range, *none can best it!* Write for details and literature.

100% of All Metal Cutting Jobs Can Be Done at Lower Cost with D. A. Stuart's Wise Economy Plan *Ask about it!*

OUR 85th YEAR

D.A. Stuart Oil Co.

2727-49 South Troy Street, Chicago 23, Illinois

THE TOOL ENGINEER'S *Service Bureau*

Accessories

Specifications and prices (including quantity discounts) of additions to line of machine and tool accessories, including hand wheels, clamping levers and machine handles in Catalog No. 50. *George F. Bub & Son,* 6011 Bradley Ave., Cleveland 9.

Bolts

Mounting, bolster and T-bolts and nuts and washers made to JIC standards listed with specifications in circular by *West Point Mfg. Co.,* 19625 Merriman Court, Farmington, Mich. T-bolt prices included.

Boring and Turning Machines

Catalog K-1, K-2, K-3 and K-4 show King vertical boring and turning machines, sizes from 30 in. to 144 in.; complete description and specifications included. *American Steel Foundries, King Machine Tool Div.,* Cincinnati 29.

Charts, Comparator

Illustrated bulletin presents optical comparator charts for radius, grid, protractor and screw thread, giving illustrated explanations, specifications and information for ease of ordering. *Jones & Lamson Machine Co.,* Springfield, Vt.

Cutting Equipment

Odd and intricate shaped steel forms cut by electric-eye flame cutting equipment illustrate folder setting forth versatility, economy and other advantages of method adapted for customer service. *Joseph T. Ryerson & Son, Inc.,* Box 8000-A, Chicago 80.

Cylinders

Catalog covers line of air and hydraulic cylinders with cut away and specification drawings and tables; includes charts to aid engineers in determining cylinder requirements. *Hydro-Line Mfg. Co.,* 711 Nineteenth St., Rockford, Ill.

Drill Bushings

Catalog B-1018 gives general information on standard line of drill jig bushings, locating pins, rest button lock screws and clamps; drawings, tables of specifications and tolerances, net price list and condensed data sheet included. *Universal Engineering Co.,* Frankenmuth, Mich.

Drills

Pamphlet gives price and specification lists and advantages of pictured "NTS" carbide drills and carbide centerdrills for drilling hardened steel. *National Tool Salvage Co.,* 6511 Epworth Blvd., Detroit 10.

Dust Suppression

Twenty-seven-page report on dust cupola suppression based on questionnaire to smoke abatement and air pollution officials through country; outlines varied methods with photos, charts, operating data. *Gray Iron Founders' Society, Inc.,* 210 National City-East 6th Bldg. Cleveland 14.

Gages

Catalog DTP-491 illustrates and describes various models of company's dial type Precisionaire, showing typical applications, tables of specifications and ranges and operating instructions. *The Sheffield Corp.,* Dayton 1, Ohio.

JIC Standards

Reprint of JIC hydraulic standards for industrial equipment; includes standard symbols, comparisons with cut-away illustrations on interesting points. *Miller Motor Co.,* 4027 N. Kedzie Ave., Chicago 18.

Lathe Tools

Folder LT-49 deals with company's standard carbide tipped lathe tools, straight or angle face, square or pointed nose and offset facing or turning; tables and drawings show specifications. *New England Carbide Tool Co., Inc.* 60 Brookline St., Cambridge 39, Mass.

Lubrication, Turbine

"Turbo-Drive" discusses problems of oxidation, emulsification, forming and sludging relative to turbine lubrication; presents features of company's special turbine oil, Turbo-Drive. *E. F. Houghton & Co.,* 303 W. Lehigh Ave., Philadelphia 33.

Marking

Shipping data and marking applications subject of stencil section of Pannier Encyclopedia of Marking with additional material covered; eight basic classifications segregate kinds of markings. *Pannier Corp.,* Pannier Bldg., Pittsburgh 12.

BOOKLETS, CATALOGS CURRENTLY OFFERED BY MANUFACTURERS

Metallurgy, Powder

Bulletin 149 explains what powder metallurgy is, points out advantages and range of applications. *American Sintered Alloys, Inc.*, 968 Farmington Ave., West Hartford, Conn.

Presses

Design features and specifications for company's recently expanded line of open-back inclinable presses, from 90 to 250 ton capacity, outlined in illustrated Bulletin OBI-49. *Verson Allsteel Press Co.* 9336 Kenwood Ave., Chicago 19.

Shears

Line of steel foot shears pictured in bulletin 80F-A which gives general uses and features plus details and specifications for short, medium and long cutting length series. *Niagara Machine & Tool Works*, 637-697 Northland Ave., Buffalo 11.

Stamps

Folder pictures line of standard code symbol stamps for date coding, piece work symbols and other uses; *M. E. Cunningham Co.*, 169 E. Carson St., Pittsburgh 3.

Steel

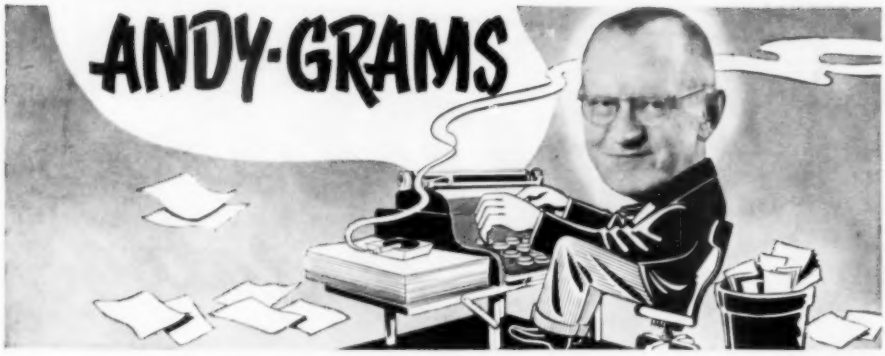
Brochure announces "Unicut" (formerly Universal), general purpose high speed steel; includes chemical analysis, applications, data chart showing hardening and tempering curve. *Universal-Cyclops Steel Corp.*, Dept. TE, Bridgeville, Pa.

Turret Attachment

"Star sensitive" turret attachment fully described in folder presenting uses and advantages of precision built tool for operator control of tapping and other operations. *Williams & Hussey Machine Co., Inc.*, Wilton, N. H.

Weight Printer

Scale that prints weighing records described in booklet P1135; tables detail the available models and printing capacities, engineering drawings give dimensions for space planning; examples of printing pictured. R. F. Miller, Sales Promotion Dept., *The Yale & Towne Manufacturing Co.*, Philadelphia Div., Philadelphia.



Dear Andy:

I like the Andygrams in January issue . . . . . as a member am proud to find in . . . . ASTE the breadth of understanding which stands out so clearly in what you say . . . . Living problems such as you touched upon in your Grams might some day yield a pleasant solution if something similar to an Operation Schedule could be worked out for the homes.

With sincere regards,
Ethan W. Vars, Duncannon, Pa.

Well now, that's a real nice letter, from which I've deleted most of the bouquets. Glad somebody likes the Grams. What particularly interested me, however, was the Operating Schedule or "bill of rights" which accompanied the letter. Our friend Ethan has worked out a system whereby Pa can have all the spending money he needs and Ma can have a new hat without asking Pa, the same going for Junior and Sis.

Best of all, the family need never worry about a depression once the foundation has been laid, apropos which I suggest that you boys N.E.W.S. drop Ethan a line requesting the lowdown. Only, I'd include return postage—yes, and a thin dime besides to help defray costs of mailing. No fair taking advantage of a right guy.

As for all that, we've worked out a pretty good system in our own home, although full credit goes to the silent partner, to whom I turn over my stipend. She salts it down until needed, everybody having enough in the meanwhile. And having enough is one of the "freedoms from fear". At that, there's a lot of difference between existing on enough and living with plenty.

Also, among letters, one from Gustav Almkvist, Bofors, Sweden, who regretfully resigned membership a/c the current devaluation of money. (More reason for trade equity, as suggested in January Grams) Gus praised the T/E Handbook most highly—"exceeds superlatives"—which should please the many contributors to that tome. The point is that, with typical courtesy, he resigned voluntarily; consequently, he can be reinstated at any time, along with a most cordial welcome, without having to pay the $5.00 reinstatement fee.

You know how it is, some members let their membership lapse, all of which entails a lot of correspondence, bookkeeping and several months free service that, in most instances, far exceeds the nominal reinstatement fee. Keep that in mind, you boys N.E.W.S. when you feel like dropping out. Better yet, pay your dues and stay in. No other technical society gives you as much for your money.

In reviewing Gadgets, I ran across one from Art Christensen of Lockport, N.Y., which I thought had possibilities for manufacture, and so suggested to the contributor. You know how it is; you publish an idea and then you're in trouble in event of applying for a patent. But Art—who incidentally is Veep of the Niagara Instrument Corp'n—said run it anyway and so you'll see it after a while.

In token of my good intentions, however, he mailed me several of these Cico tungsten carbide scribers his company makes. Couldn't wait to try one out down in my hobby shop, and of all things to cut a pane of glass! And it did, only I don't imagine they were intended for such use. However, it proves their quality, especially for scribing on hardened steel.

Among visitors, Sven Hansen and running mate Mr. Swingley from Cooper-Bessemer Corp'n, Mt. Vernon, Ohio, dropped in at H.Q. Asked to take 'em around, I first initiated them to smörgasbord at The Stockholm. Then, after a brief stop at Areo-Nat Tool & Die and a handshake with Andy Anhollt at Gatco, where they saw rotary bushings being made, to Snyder Tool & Engineering, where genial George Whitehouse did the M/Cing. Then to Micromatic Hone, where Bill Pinkerton did the hosting. A real pleasant round of visits.

Also, among visitors, Ernst Nieman from St. Louis, with whom I relayed greetings to Ed Doogan's Old Man, Jake Demuth and Willis Ehrhardt. Didn't place Ernie at first and was trying out my memory system when Jack Eacock, our office manager, kibitzed and spoiled the game. Not that I didn't remember the face and the friendly smile; it was just that I couldn't reconcile the person with time, place and the name.

For some time past, associates around the office have been hinting that I get a hearing aid. Well, you know me, always willing to oblige, so I tried a few of the gadgets and a guy came around to the house with a sample, but after talking about the state of the union for fifteen minutes or so he said: "H- mister, you don't need a hearing aid as long as people talk normally."

One thing about my hearing, I can shut out noises and conversation that I don't want to hear—helps concentration immensely. But here's one for the book: Attending a symphony concert t'other evening, a lady across the aisle came over, tapped me on the shoulder and whispered: "Sir, would you mind not jingling your coins?" And y'know, the orchestra was in high gear, drums booming and cymbals clashing, and me jiggling a lone thin dime! Phooey on such hearing!

From one thing to another, I just received an autographed copy of Prof. Alex Gwiazdowski's latest book—*Engineering Metallurgy*—which, while written as a text book for students, contains plenty of "refresher" material for veteran tool engineers. I personally worked with Gwiazdowski at Hoe Printing Press Co., New York, back around '08. An apprentice at the time, studying engineering and chemistry evenings at Cooper Union, he has since spent years at production, engineering and teaching. In other words, he's got the knowhow from fundamentals up.

Returning to Poland shortly before the war, he was made a prisoner of the Nazis and later of the Reds. Released after considerable tribulation at the close of the war, he returned to the States and, for a while, served as editorial associate with The Tool Engineer. He then accepted a professorship at Tri-State College, Angola, Indiana, where, in addition to actively promoting the ASTE, he is busily training future tool engineers. Thanks for the book, Prof.

Speaking about the Stockholm—as above—I attended a party there a few evenings ago, the occasion being the showing of color movies of South America by Nils Inghagen of the Stockholm management. You should see 'em—they're just out of this world! Anyway, he took us to Buenos Aires and thence through Patagonia, and up Chile, then across the Andes to Rio and Sao Paulo, where ASTEer Gene Lahr makes his home. Incidentally, Gadgeteer Federico Strasser lives in Santiago de Chile, so I had opportunity to vicariously visit the home towns of two of our South American friends.

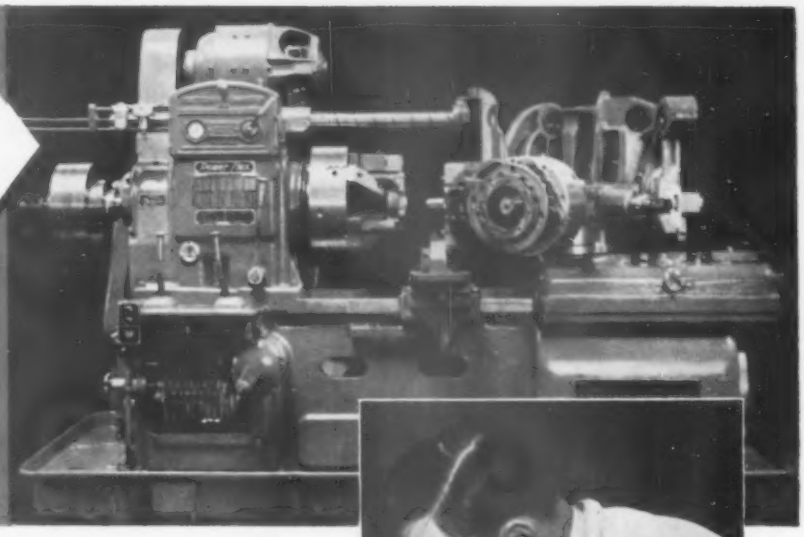
When it comes to civic beauty, we trail far behind our South American neighbors. The cities are as modern as tomorrow, with beautiful apartment houses reminiscent of Stockholm and no dearth of modern skyscrapers. Rio is undoubtedly the most beautiful city in the world, and Sao Paulo is a close runner up, lacking only Rio's marvellous beaches and ocean front. And that's all for now, hoping I've done my bit toward good neighborliness. *Hasta manana, senors—and senoritas.*

Handily yours,

Andy

P&J TOOLING on P&J AUTOMATICS

does the (w)hole job *better — faster cheaper*



Production costs mount up fast when multiple drilling requires extra work handling, extra machining, extra time, often extra machines. You avoid all these "extras" when the job is done — *in one holding* — with P&J TOOLING on P&J AUTOMATICS.

There's no secret to the P&J method. It's simply skillful tool engineering based on 50 years of specialized experience. Typical examples of P&J Tooling are these self-driven Multiple Spindle Drill Heads — all designed for drilling, countersinking or reaming multiple holes directly from the turret of a P&J Automatic. They index to exact alignment, engage with the work chuck which rotates the Drill Head; drive is transmitted in correct speed ratio to the drills. The (w)hole operation is fast, precise, fully automatic — and results in better work, and more of it at lowest possible cost per unit.

When multiple drilling is part of your machining problem, get a cost and time estimate from P&J. It's a profitable habit to acquire.

PRODUCTION TOOLING HEADQUARTERS

Potter & Johnston Company

Pawtucket, R. I.

subsidiary of Pratt & Whitney Division Niles-Bement-Pond Company

P&J

BE SURE!

And You Can be Sure of Accuracy when you use ACME TOOLS in the Shop, Tool Room, or Inspection Department for checking Flats, Angles or Heights. Made of MEEHANITE METAL, these tools are designed to maintain their rigid precision and give long service even with hard usage.

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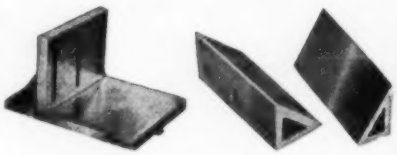
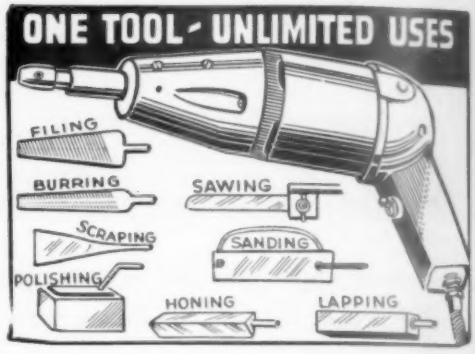


Surface Plates Rescraped Like New

PUSH and PULL

1000 times per minute—that's the number of fixed strokes produced by this Portable, Electric Tool. Its speedy action will increase production, improve quality and cut costs of numerous operations. Hand operations can be discontinued entirely.

This handy RECIPROCATING TOOL will pay for itself in no time. Operates 110 volts AC-DC.



Send us a description of your problem; we will gladly recommend the proper tool for the job.

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Please send the "Tool Engineers' Handbook" to the address below as follows:
1 copy @ $11 (ASTE member price); ..... copies @ $15 (list price). Payment enclosed in the amount of $..... Orders shipped to Canada will enter the country duty and tax free. Remittance may be made in Canadian funds at the same prices. Shipments to other countries are subject to import regulations.

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Remittance payable to the Society must accompany order. Do not send currency. Mail this order coupon or a facsimile to: American Society of Tool Engineers, Dept. 3, 10700 Puritan Ave., Detroit 21, Mich.

IMPORTANT—In order to obtain the special, member price of $11, orders must be sent to the Society.

PRECISION GRINDING ELIMINATES SCRAPING

Ex-Cell-O Spindle Finishes Dovetail Ways in 1/10 the Time Formerly Required

Actual case histories show that slide ways now being precision ground in 15 minutes formerly required 2½ to 3 hours of hand scraping to obtain satisfactory bearing. Slightly larger slides that are now precision ground in 20 minutes formerly required 3 to 4 hours of hand scraping.

Ex-Cell-O spindle engineers have a wealth of experience in designing precision spindles to meet special applications. If you don't find a spindle to suit your needs in the spindle catalog, write to Ex-Cell-O stating the operation to be performed and your requirements in terms of speed, horsepower and preferred driving method. A simple sketch showing some basic dimensions is helpful, too.

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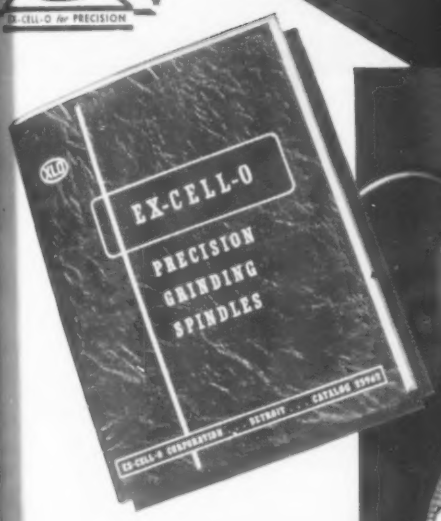

If you would like an Ex-Cell-O Precision Grinding Spindle Catalog without obligation, just write on your company letterhead, asking for Catalog Number 25962.

50-22

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For Precision Performance

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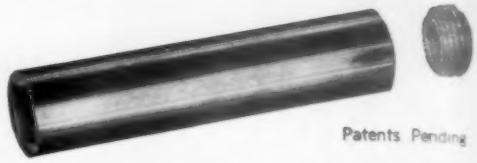
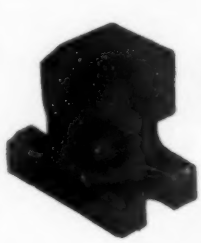
How SQUARE HOLED SLEEVES SPEED UP TOOL-MAKING!



Patents Pending

One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The Sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.



The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, tool holders and other tools requiring square holes.

BUSHINGS MADE IN FOLLOWING SIZES:
3/16, ¼, 5/16, ⅜, 7/16, ½, ⅝, ¾, 1"

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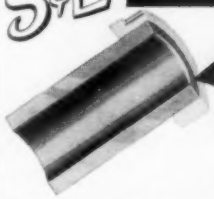

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Cut DOWNTIME . SCRAP and INVENTORY!

Speed up PRODUCTION ACCURACY and PROFITS!

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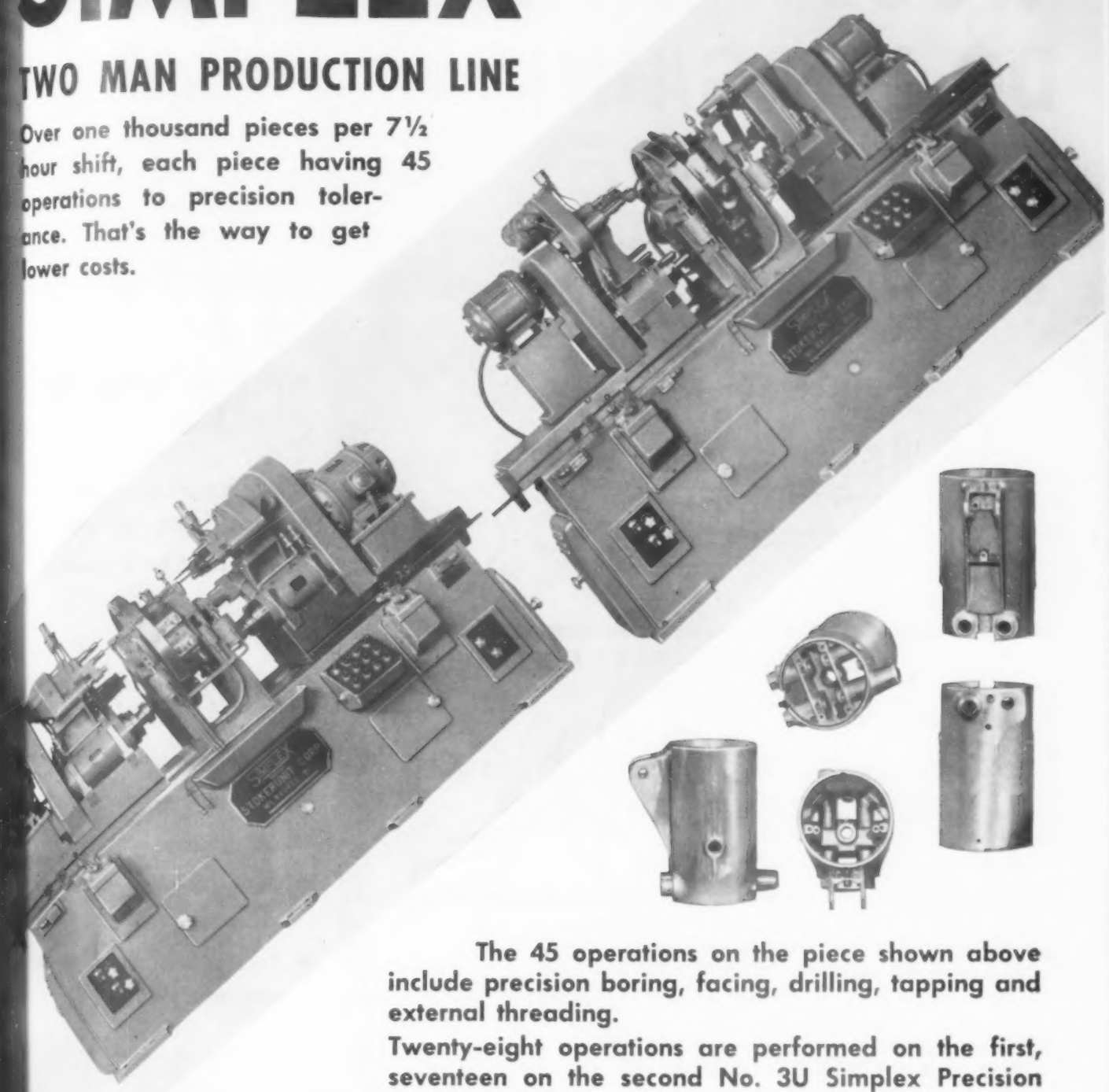
TWO MAN PRODUCTION LINE

Over one thousand pieces per 7½ hour shift, each piece having 45 operations to precision tolerance. That's the way to get lower costs.



The 45 operations on the piece shown above include precision boring, facing, drilling, tapping and external threading.

Twenty-eight operations are performed on the first, seventeen on the second No. 3U Simplex Precision Boring Machine.

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Precision Boring Machines, Planer Type Milling Machines, Special Machine Tools

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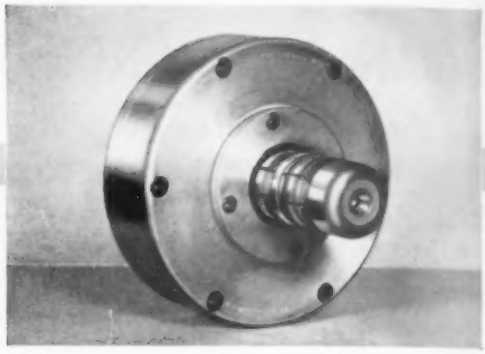
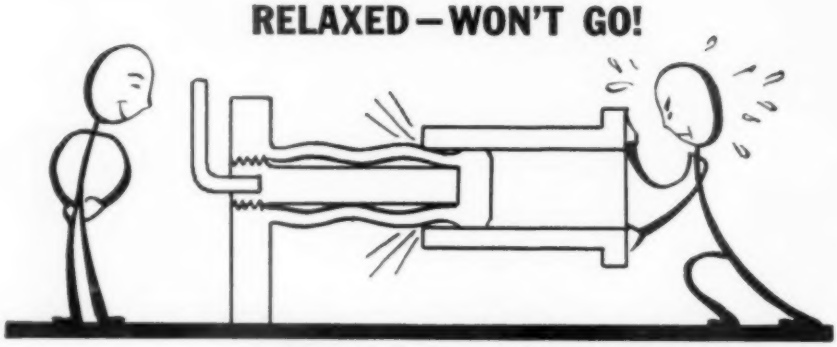
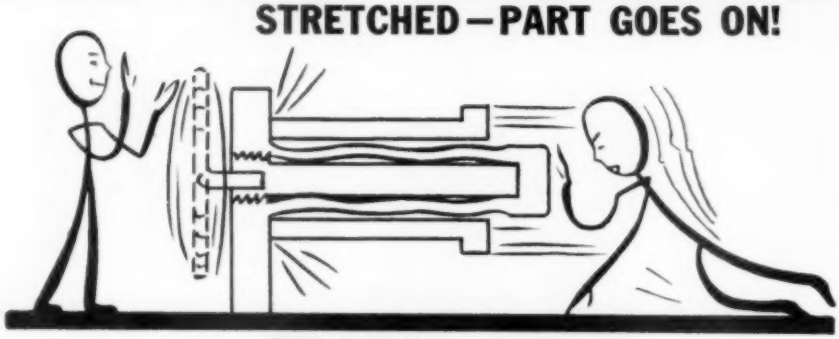
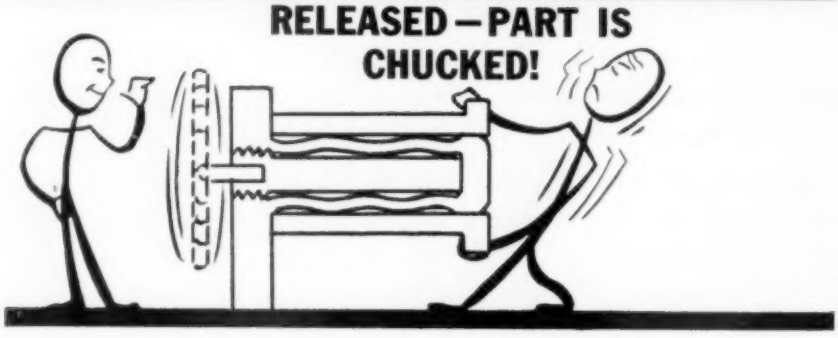


THE N. A. WOODWORTH DIAPHRAGM ARBOR







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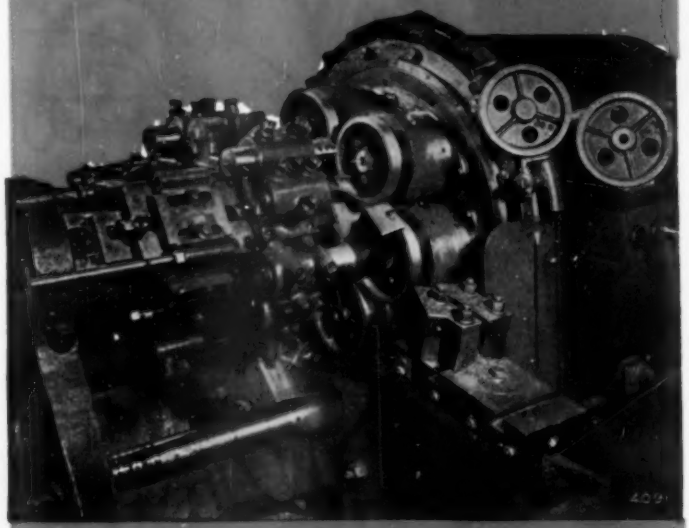
fact: gear blanks are turned with accuracy and speed on Baird Automatic Chucking Machines!



You need a Baird Automatic Chucking Machine in your shop if you have turning operations that must be done profitably. *That's been a fact since the turn of the century!*

You need a Baird because it is the one machine that you can depend upon, friend of the tool engineer and shop superintendent alike because of its speed and accuracy.

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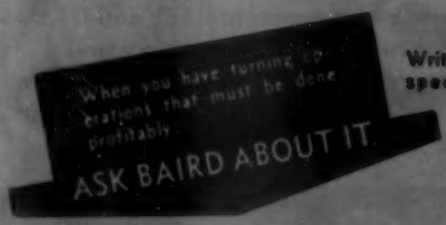
Here the special Baird feature of selection of spindle speed for each position proved its value: high spindle speeds were selected in the finishing positions so that carbide tools could be used to produce the fine accurate surfaces demanded.



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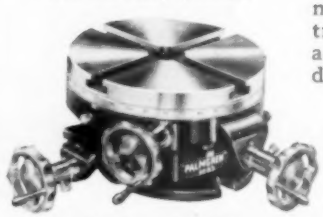

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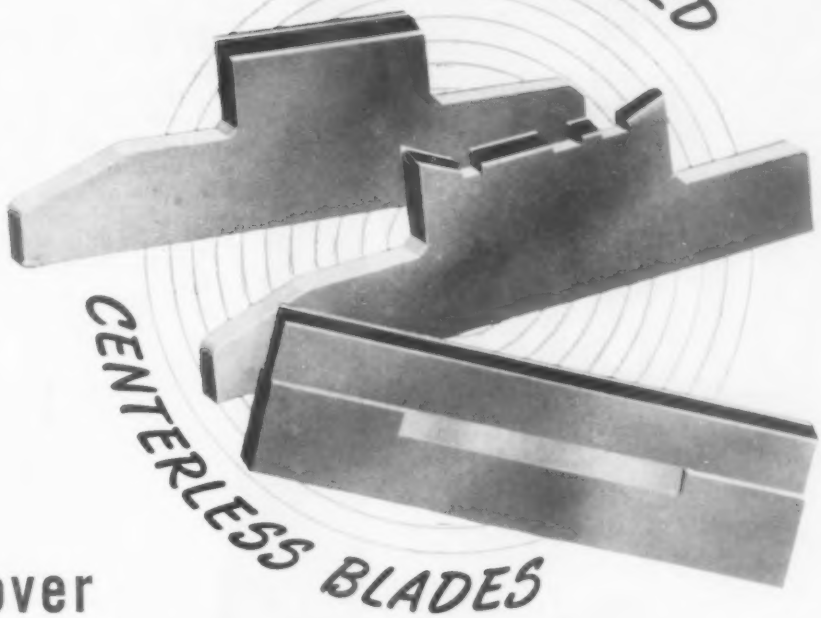

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1,000,000 PIECES per grind

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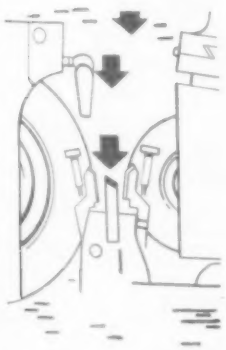

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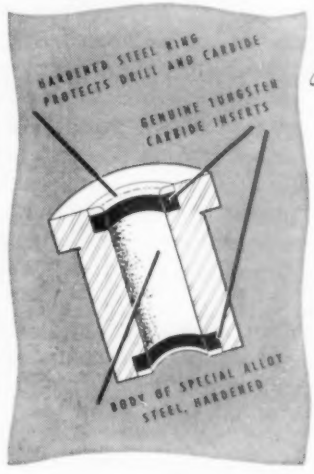
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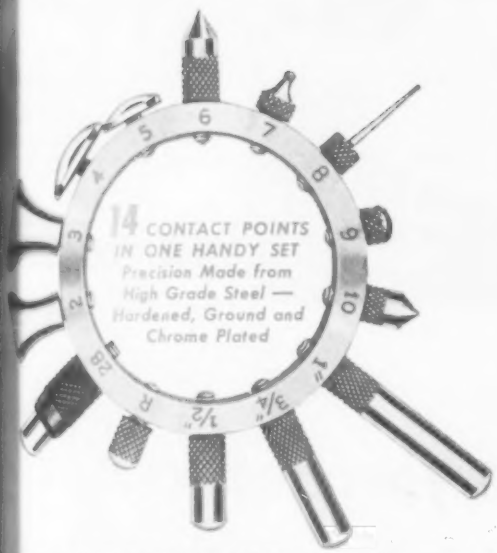

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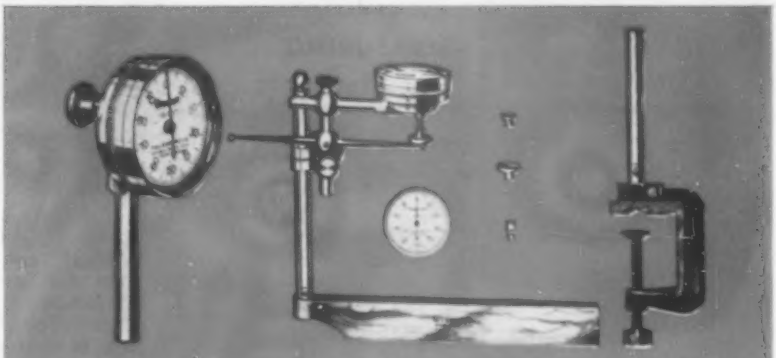

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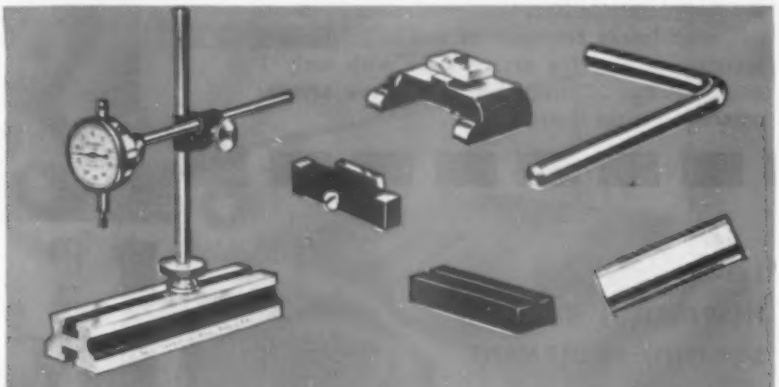
Simple, reliable, sensitive, easy to read, easy to set up and use — a favorite with toolmakers, machinists and inspectors. Special attachments provide for universal application to all classes of work. Dial graduated .001", reading 0-100, range .200". Also available to read 0-50-0, 0-20-0 and 0-40 by thousandths, range approximately .200".



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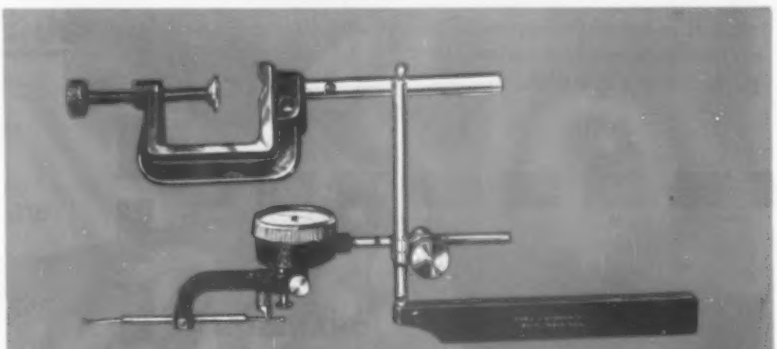

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Similar to No. 196 but proportionately heavier for severe applications around machinery or for continuous use in general tool work, No. 645 has a special, spiral-type mechanism of unusually rugged construction. Combines sensitive, accurate action with easy-to-read dial. Supplied with 0-50-0 or 0-100 dial, graduated in thousandths, range .200".

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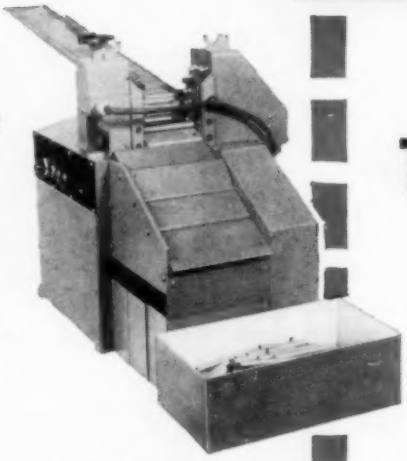

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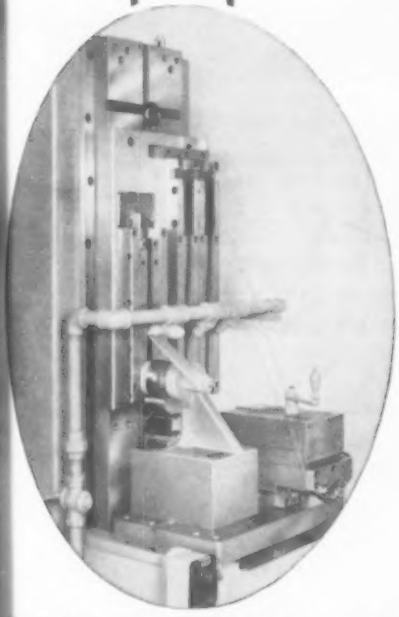

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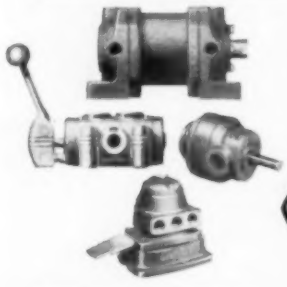

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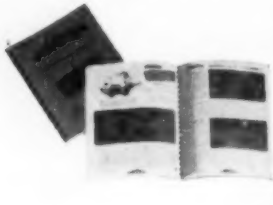

3

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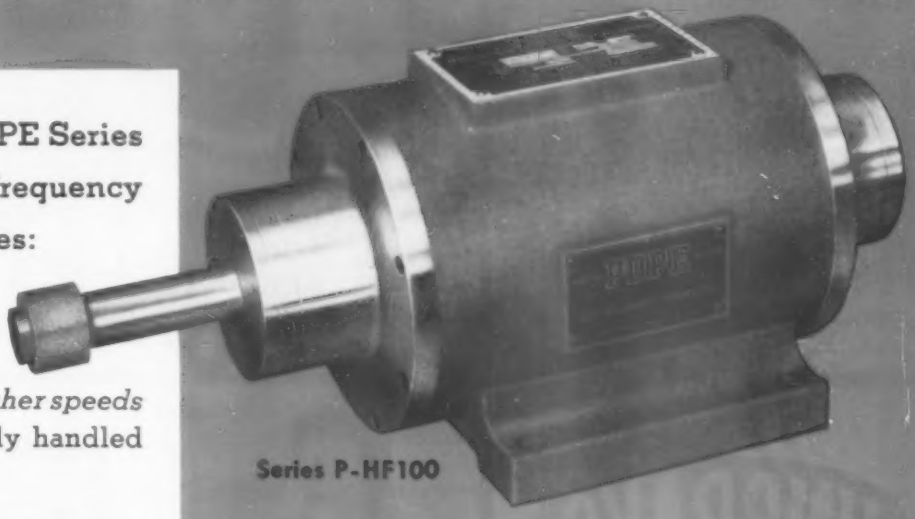

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POPE High Frequency, Series P-HF100 Internal Grinder Spindles are regularly furnished in speeds from 5400 to 54,000 R.P.M.

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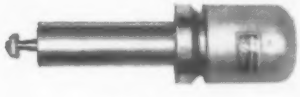

P-693

High Frequency 16,600 RPM totally enclosed fan cooled 1 HP motorized Spindle, over-all length $18\frac{3}{16}$", barrel dia. 3", barrel length 9".

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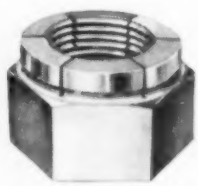

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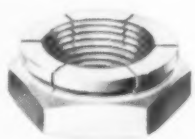

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This sensational abrasive—new and exclusively Norton—is making outstanding records everywhere. In thousands of tool rooms they are finding that "32" wheels can make substantial savings on all types of sharpening operations on high speed steels. Its unique crystal structure gives grains that are *sharper*—they penetrate sensitive high speed steels more easily, cutting faster and cooler.

38 ALUNDUM Abrasive—

The original white abrasive, "38" has been a tool room favorite for forty years and is still popular with many tool grinders. It is the recommended abrasive for sharpening jobs where feeds are very light.

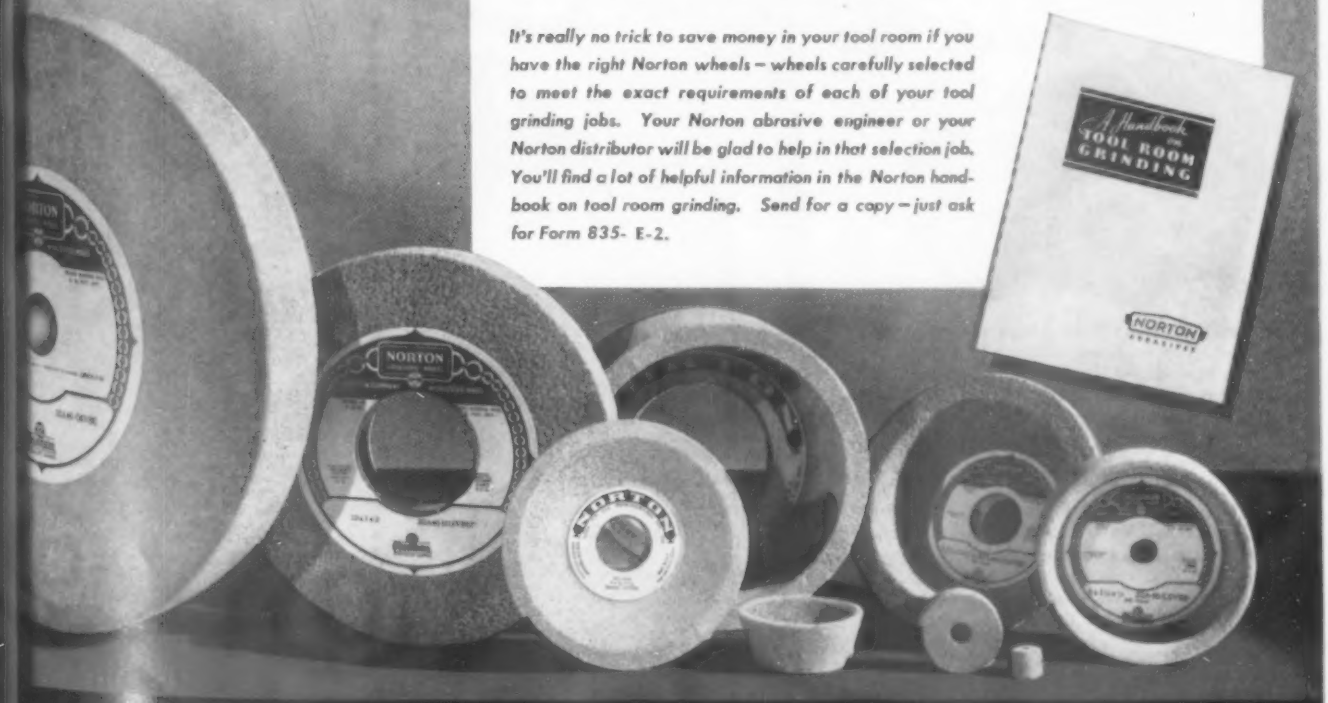
57 ALUNDUM Abrasive—

One of the newer Norton abrasives, "57" combines a fast cutting action with great toughness. Thus it is widely used for offhand tool grinding operations. Its slightly lower price also makes it popular for precision sharpening jobs in shops where the first cost of the wheel is given major consideration.

NORTON
ABRASIVES

Making better products to make other products better

It's really no trick to save money in your tool room if you have the right Norton wheels – wheels carefully selected to meet the exact requirements of each of your tool grinding jobs. Your Norton abrasive engineer or your Norton distributor will be glad to help in that selection job. You'll find a lot of helpful information in the Norton handbook on tool room grinding. Send for a copy – just ask for Form 835- E-2.



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Specializing in all types of holding fixtures for machine shop production.

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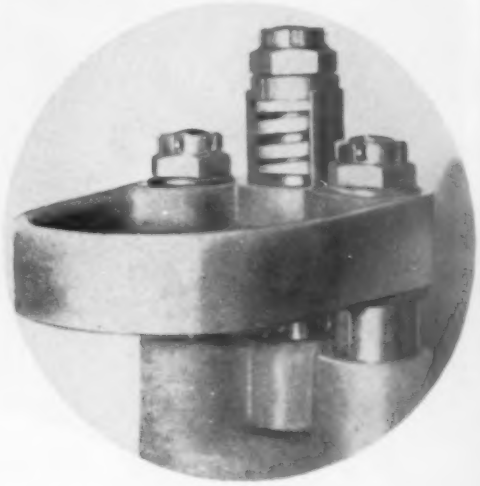


SWARTZ LS TYPE FIXTURE

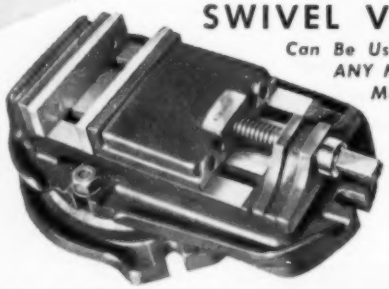
A spring jig with solid clamping, as built only by Swartz. A heavy die spring prevents loosening if heavy drill pressures for the work lower into the adapters.

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley Ave. Telephone WE 3-1522 Detroit, Michigan

CUT MILLING COSTS *with* KEMPSMITH STANDARD ATTACHMENTS

SWIVEL VISE
Can Be Used on ANY Milling Machine



Kempsmith Swivel Vises are precision tools with operating surfaces accurately ground to size and squareness. Jaws are removable and coolant return channel cast integral. Built to take hard, everyday punishment. Plain vises and heavy duty plain and swivel vises, also available. Ask for Bulletin No. 117.

Kempsmith Standard Attachments broaden the scope of your milling machine . . . lower capital investment . . . save in set-up time.

KEMPSMITH MACHINE CO.
1847 SOUTH 71st STREET
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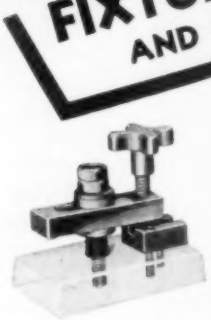
KEMPSMITH ARBORS in all popular sizes or types. Adaptable to ANY make of milling machine with standardized spindle.

KEMPSMITH

Precision Built Milling Machines Since 1888

M-T FIXTURE CLAMPS AND COMPONENTS



BE DOUBLY SURE with M-T QUALITY

FIXTURE CLAMPS — wide range of sizes and types to fit every requirement.

Jack Locks . . . Cam Locks . . . Hand Knobs . . . Hand Wheels . . . Steel Ball Handles . . . Soft Chuck Jaw Blanks . . . Fixture Cams . . . Alloy Set-up Studs . . . Rest Buttons and Rest Pads . . . Spherical and Plain Collar Nuts . . . Quarter Turn Screws . . . Fixture Keys . . . Spherical and Flat Washers . . . Shoulder Screws and many other items from stock.

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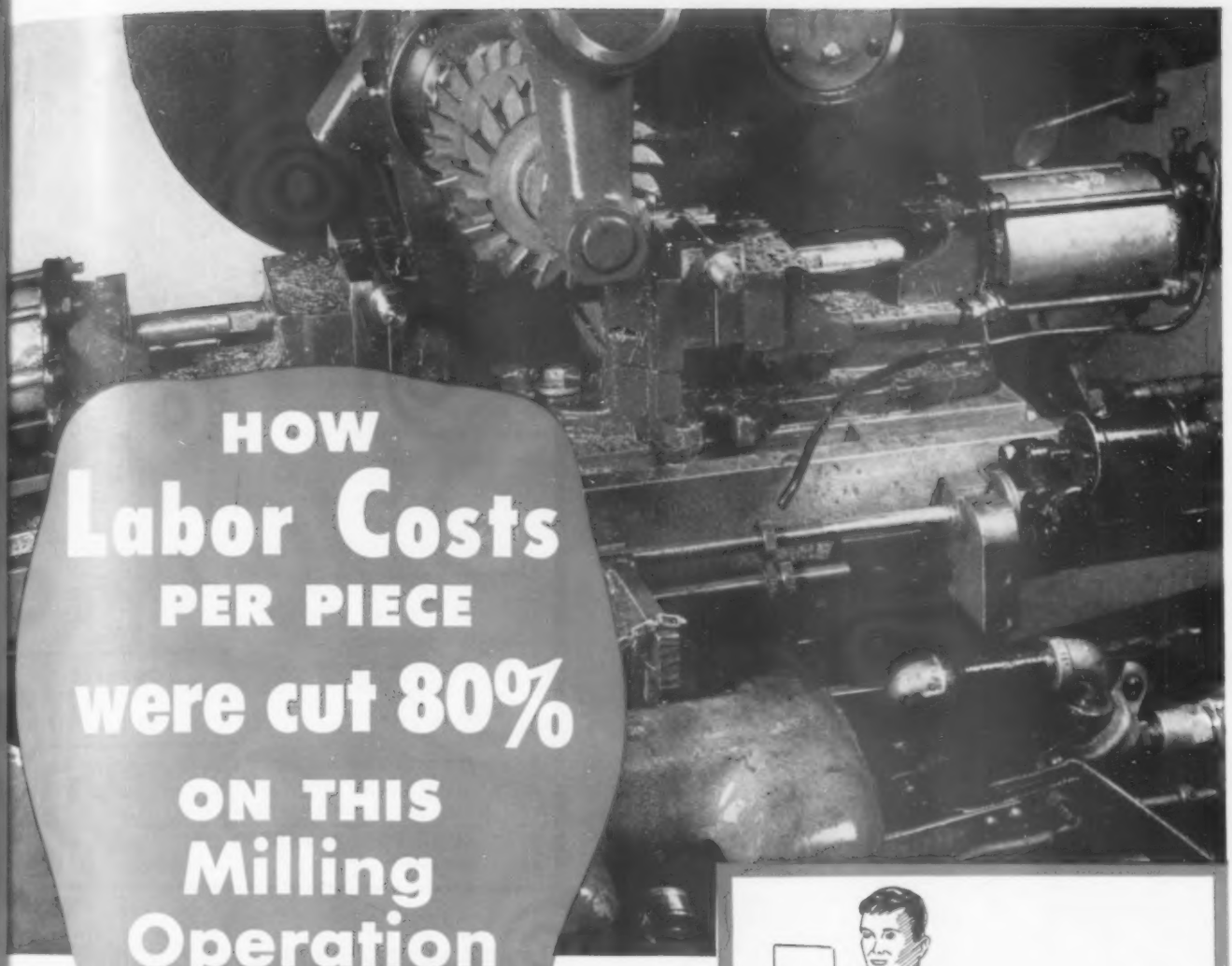


HOW Labor Costs PER PIECE were cut 80% ON THIS Milling Operation

THE cost of milling an anchor pin in this midwestern plant was running too high. The part was hand clamped and hand milled—one end at a time on a standard hand milling machine.

A Bellows Field Engineer suggested that the operation could be made simple and inexpensive with Bellows "Controlled-Air-Power" Devices.

A continuous action Bellows Air Motor was installed to traverse the table. Two Bellows Hydro-Checks served to control the table movement, assuring positive smoothness of feed and eliminating any back lash or chatter.

Bellows Air Vises were mounted on both ends of the table and were linked to the bed to open and close automatically.

As the unit now operates the operator loads one vise while the other is under the cutter. Once the unit is started all operations except loading and unloading are continuous and automatic.

The result: *Labor costs per piece were cut 80%; production jumped from 75 pieces per hour to over 400; cutter life was increased 600%.*

VISIT BOOTH 802 ASTE *Cost-Cutting* EXPOSITION

•

See how Bellows "Controlled-Air-Power" Devices can help you cut costs in your operations.

•

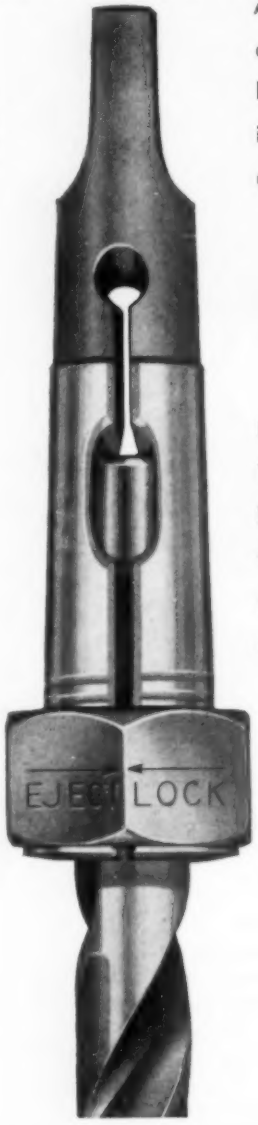
If you can't make the show write us for the latest Foto Facts File Series. It's filled with ideas to help you save money through "Controlled-Air-Power". Write The Bellows Co. Dept. TE-350, Akron 9, Ohio.

The Bellows Co.

AKRON, OHIO

For TOUGH JOBS USE *Eject-or-Lock* Utility TOOL DRIVERS

Save wear and tear on expensive machines. Use a wrench instead of a hammer to release drills and other small tools from spindles where machine or work interferes with the use of a drift.



A quick twist of nut to the right ejects both driver and drill — to left locks driver and new drill securely in position with that EXTRA GRIP needed for tough drilling.

EXTRA CLAMPING ACTION

Having trouble with tough jobs? The EXTRA GRIP of these Eject-OR-Lock Drivers will keep your drills turning in those really tough materials, reduce resharpening and replacement costs.

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Designers and Manufacturers of Dependable Tools since 1919

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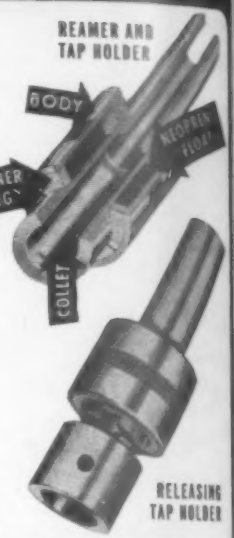
Neoprene Mounted FLEXIBLE
TOOL HOLDERS

Tool-flex* floating tool holders with long-lasting, oil-resistant neoprene insert holds your reaming and tapping tools perfectly centered. Yet the resiliency of this tough composition rubber product gives needed flexibility, cushions against shock thus **reducing tool breakage**, and makes possible **automatic correction** of misalignment. This self-centering tool drastically cuts setup time and reduces rejects.

Simplicity of construction . . . only four main parts . . . virtually eliminates maintenance and make Tool-flex long-lasting and replacement negligible.

Tool-flex holders are adaptable to any position and especially the releasing type which are very adaptable to screw machine work.



Tool-flex
MADE IN ANY STYLE SHANK OR COLLET

Write for information . . . Dealer inquiries invited

*NEOPRENE-MOUNTED FLEXIBLE TOOL HOLDERS MANUFACTURED BY

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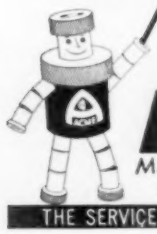
3743 DURANGO AVE. • LOS ANGELES 34, CALIF.

"...it's the bushing that makes the wHOLE difference"



To maintain maximum accuracy in drilling operations, use the bushing that's precision made for the job...use Acme. Write for catalog.

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Makers of Hardened and Ground Precision Parts
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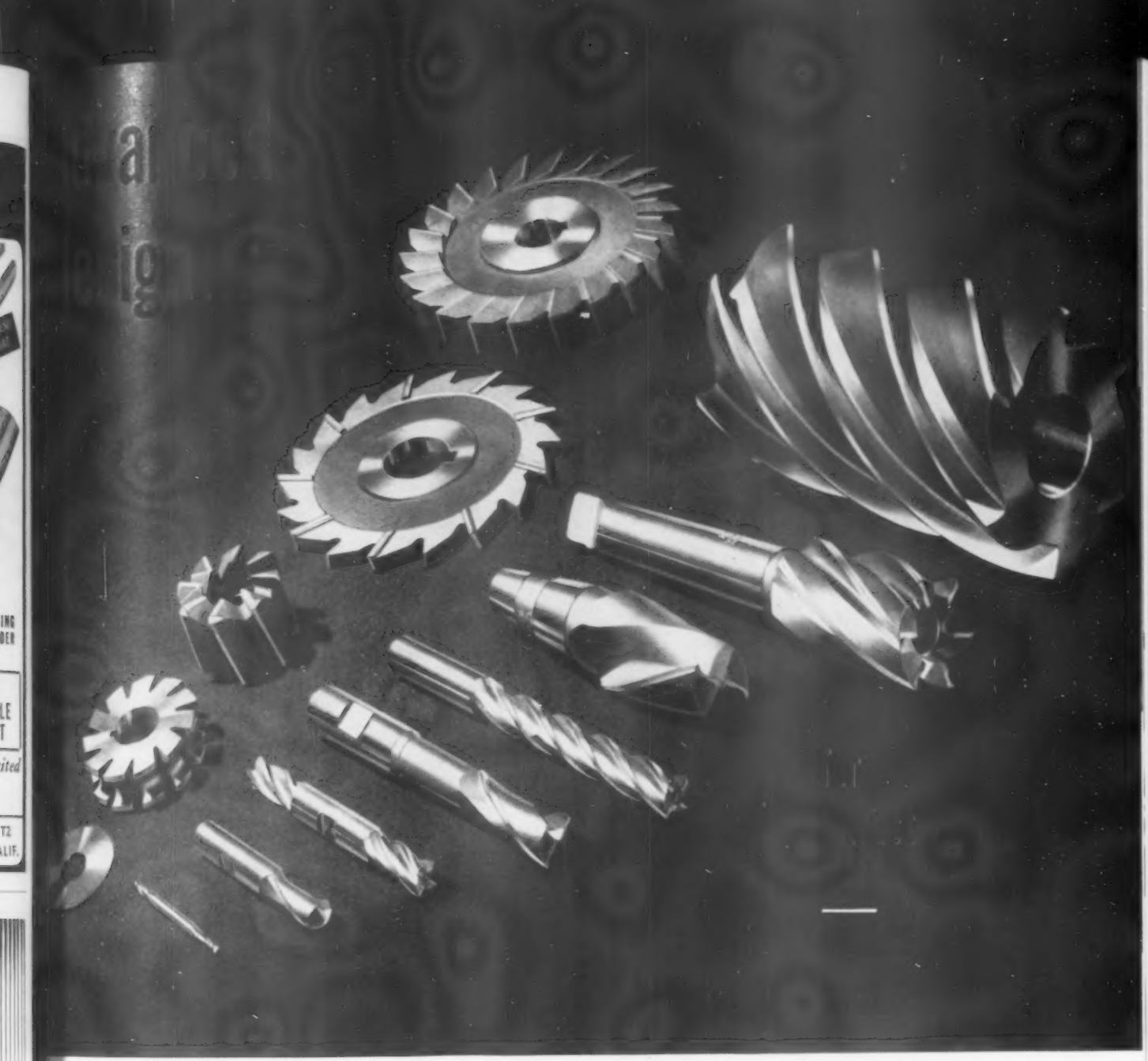
THE SERVICE SHOP TO INDUSTRY FOR MORE THAN 25 YEARS



To help you take full advantage of more efficient machines and new materials, Brown & Sharpe engineers are constantly testing and developing new designs in cutters. In the development of the most practical cutters, diversified manufacturing in Brown & Sharpe's own plant provides an exhaustive testing ground.

Brown & Sharpe cutters have many advanced features of design that permit highly efficient operation. Their dependable performance assures *more* as well as *better* work.

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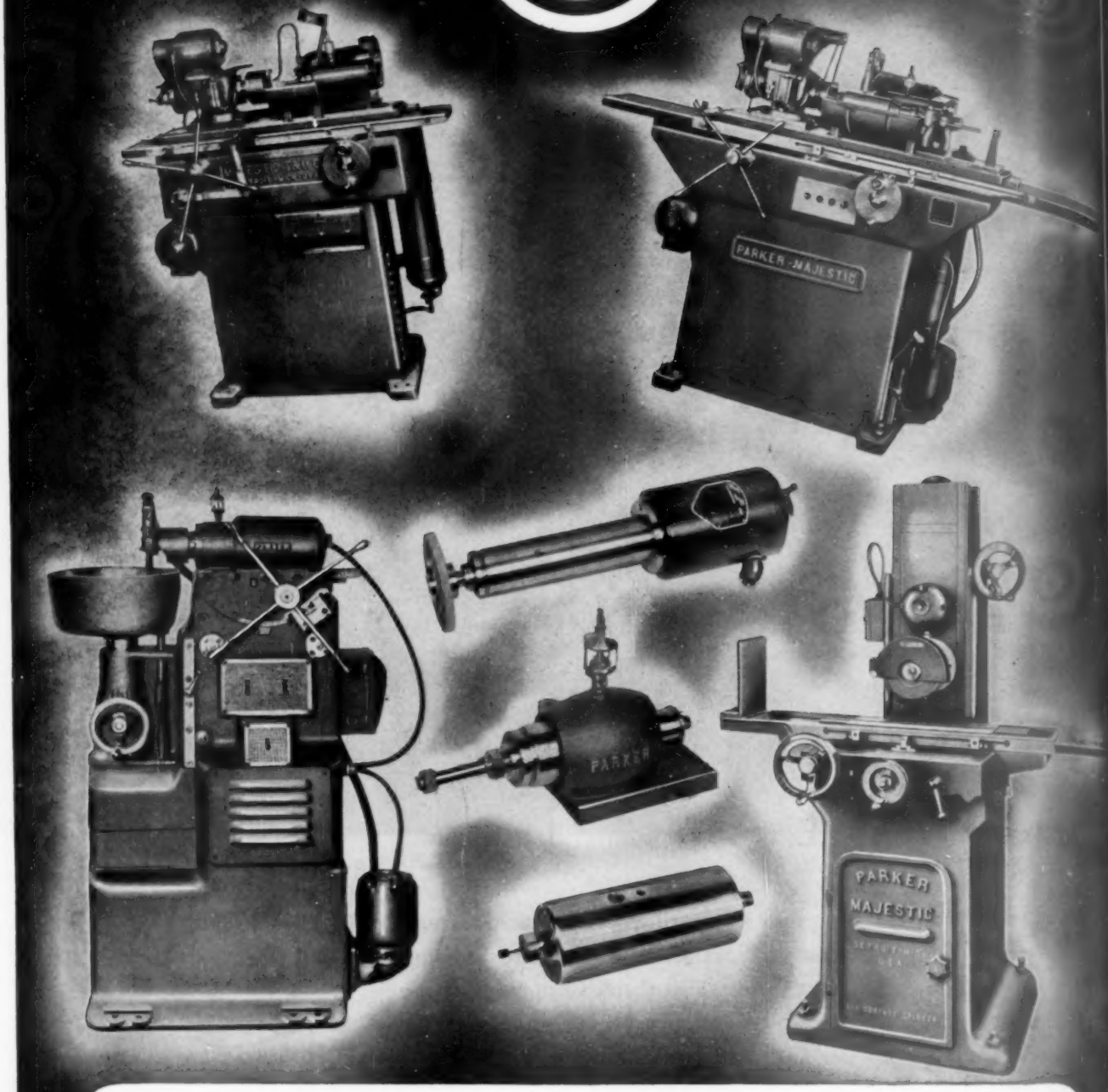
PRECISION MACHINES PM PARKER • MAJESTIC



Since 1907, the name of Parker has been a part of the progress of the automobile industry.

In 1915, Parker introduced the basic principle of ball bearings in grinding manufacture—a major advance in grinding which was unknown at that time.

A few years later the Parker Ball Bearing was patented to meet high speed and precision requirements and has been in use ever since.

Further research and engineering development brought forth the well-known Parker Majestic External and Internal Grinding Machines, each machine representing a great advance in simplicity of operation and precision.

The latest tooling development of the company is the Parker Majestic No. 2 Surface Grinder that provides new accuracy and flexibility for small grinding operations.

These many products of Parker Majestic will continue to serve the great automotive industry in the future, keeping pace with its demands for speed, accuracy and dependability.

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MAJESTIC TOOL AND MANUFACTURING COMPANY

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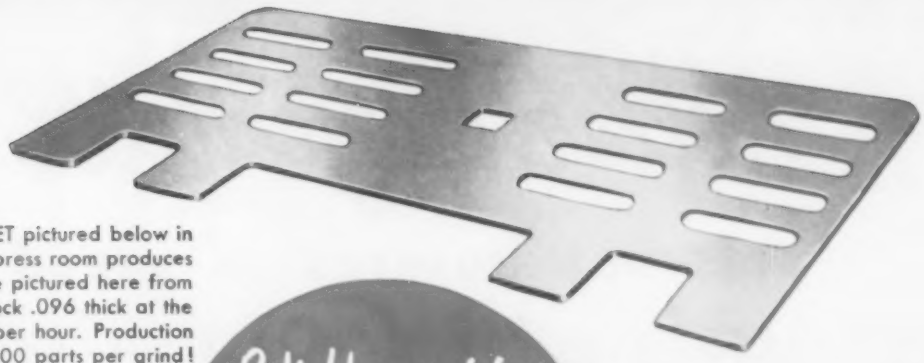
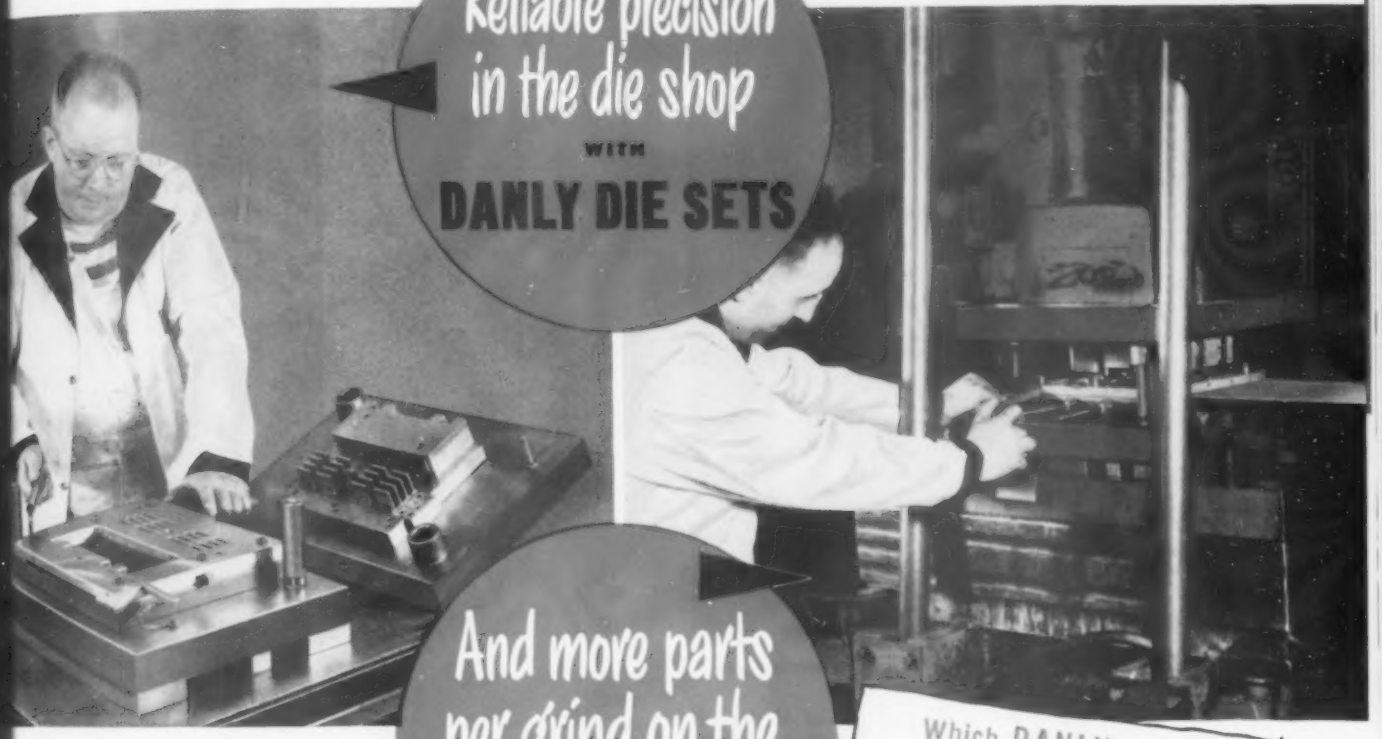


The DANLY DIE SET pictured below in the shop and in the press room produces the pressure plate pictured here from 1010 C.R.S. strip stock .096 thick at the rate of 600 pieces per hour. Production averages 100,000 parts per grind!

Reliable precision in the die shop WITH DANLY DIE SETS



And more parts per grind on the production line!

HERE'S WHY...

Hardened, ground and lapped pins make die assembly work quicker, easier and more accurate. Close guide post and bushing fits assure precise die relationship and longer die life. Danly Die Sets assure the lasting performance of your dies.

And they mean greater convenience, too! Whatever your needs, a Danly Die Set is quickly available. All standard sets are stocked in a nationwide system of Danly assembly branches!

Which DANLY branch is closest to you?

- * Chicago 50, 2100 South 52nd Avenue
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- * Grand Rapids, 113 Michigan Street, N.W.
- * Long Island City 1, 47-28 37th Street
- * Los Angeles 54, Ducommun Metals & Supply Co., 4890 South Alameda
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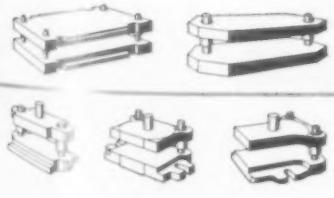
- Philadelphia 44, 18 West Chelten Avenue
- * Rochester 4, 16 Commercial Street

* Indicates complete stock

WRITE FOR THIS FREE BULLETIN

... and see how Danly's special die set machining service will mean important savings in your tool shop.



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DANLY MACHINE SPECIALTIES, Inc.

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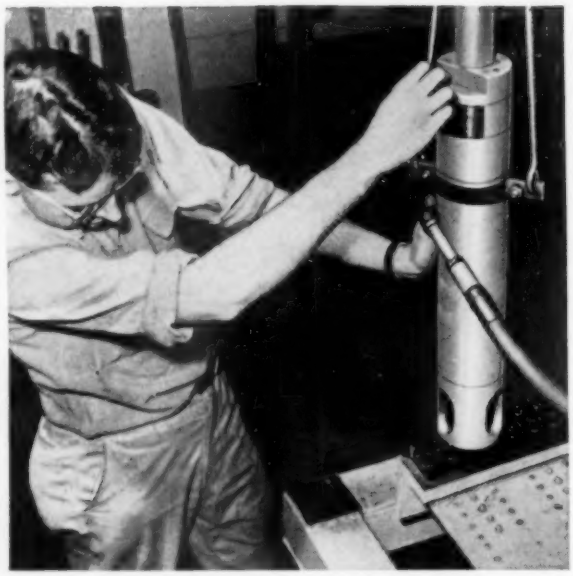
OVER 25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

Keller Airfeedrill

sets new records in speed and accuracy for production drilling



Drilling barrel nut holes, center wing section

Keller Airfeedrill comes to the job instead of the job coming to the drill. Drilling fixture is prepared in advance, with a lock-liner bushing for each hole to be drilled. This fixture is registered on the wing section and secured with C clamps. The Airfeedrill may be lifted from bushing to bushing, or supported by a tool balancer so that when released it will rise above work level and be readily lowered to next drilling operation.

Drilling is entirely automatic. Feed may be regulated to suit conditions, break-through is velvet smooth. Shut-off can be either manual or automatic. The operator never touches the Airfeedrill during the cutting operation.

Hole lineup can be as accurate as required. Run-out or out of parallelism can be held to tolerances measured in tenths . . . well within the requirements of modern application.

If you have multiple holes to drill and ream and great accuracy is a requirement, investigate what Airfeedrills can do for you.

4 great Airfeedrill Advantages

- Easy and economical to set up initially.
- Fixture setups need not be permanent.
- Can often be used in existing fixtures by simply mounting Airfeedrills in bushing holes in fixture.
- Fast and accurate control of stationary drills when equipped with Keller Four-way Air Valves.

Keller Pneumatic Tools

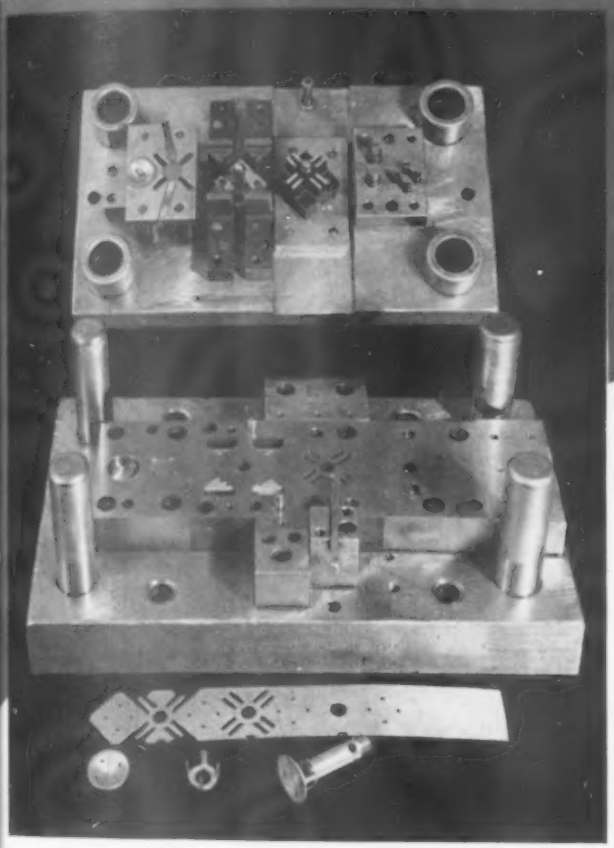
Keller Tool Company, Grand Haven, Mich.

A-H5

(5 PCT CHROME AIR-HARDENING)

A Toolroom Favorite on 5 counts

1. **Air-hardening for safety.**
2. **Good wear-resistance.**
3. **Good toughness.**
4. **Excellent resistance to deformation.**
5. **Easy to machine.**

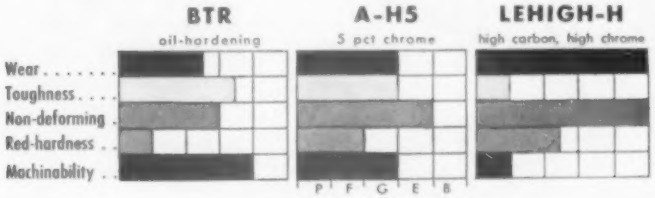


"A-H5 always meets or exceeds our expectations . . ."

This comment comes from the chief engineer of Day and Night Division, Affiliated Gas Equipment, Inc., in Monrovia, California. This company makes a modern line of gas, space and water heaters for home and commercial uses. The die shown is used to pierce, blank and form burner canopies from .0235-in. stainless-steel strip. With all its parts made of A-H5 except the punches (they are Lehigh H), this progressive die is still going strong after producing several hundred thousand pieces, samples of which are shown in the foreground.

There's plenty of versatility in this 5 pct chrome, air-hardening tool steel. And it's economical, too, often replacing more expensive grades.

A-H5 is a general-purpose steel that fits in between the standard oil-hardening steels (such as Bethlehem's BTR) and the high-carbon, high-chrome tool steels like Lehigh H (another Bethlehem champion). Here's a quick comparison of the properties of all three:



(Poor, Fair, Good, Excellent, Best)

Use A-H5 for a variety of dies, punches, blanking tools, cold-forming dies, master tools, gages, and the like. Give it a thorough trial and you'll be sold on having it in your toolroom to stay. Let the nearest Bethlehem sales office or tool-steel distributor give you complete information. Quick delivery from our mill depot or local distributor's stock.

HEAT-TREATMENT OF A-H5

	C	Mn	Cr	Mo	V
Typical Analysis:	1.00	0.60	5.25	1.10	0.25

Annealing: Pack, heat to 1650 F, slow furnace-cool, Brinell 212 max

Preheating: 1200 to 1250 F, prior to hardening

Hardening: 1775 F, air-quench

Tempering: 350 to 400 F, Rockwell C 60 to 62

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation

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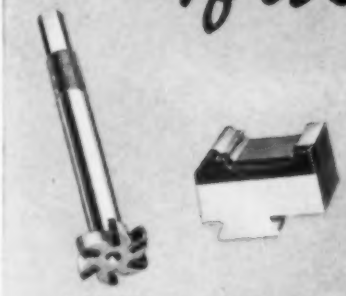
BETHLEHEM STEEL

Bethlehem SUPERSONIC TESTED **Tool Steel**

If it's a

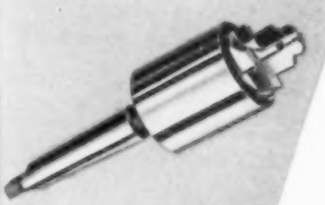
CARBIDE TIPPED
CUSTOM QUALITY
CUTTING TOOL

you need-

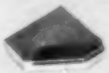


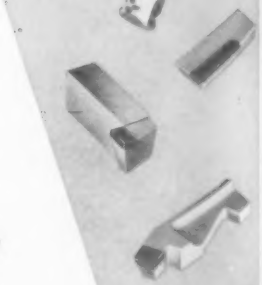
LOOK NO FURTHER THAN THE NAME

GORHAM



Carbide tipped cutting tools by GORHAM are custom built to your specifications—the finest quality made. Our engineers are experts in the design, application and manufacture of carbide tipped tools. When you want a "special" tool for a special job, call GORHAM to solve your problem. Our long experience in the field will help you do the job faster, better, more economically. The facilities of our modern plant are at your disposal.





GORHAM TOOL COMPANY

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SPECIFY *Van Keuren*

WIRE TYPE PLUG GAGES
Carboloy
Chromium Plate
High Speed Steel
Alloy Tool Steel

Full 1⅞" and 2" length units may be cut to make 2, 3, or 4 gages . . . Always accurate. No rejections. Long life aluminum handles. Prompt delivery from a stock of 2 million wires.

Van Keuren Wire Type Gages are made to Class B accuracy +.00005" —.00000" on the Go units and ±.000025" on the No Go units. Closer or wider tolerances can be supplied if desired.

Catalog and Handbook No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.
It presents for the first time in history a simple and exact method of measuring screws and worms with wires.
It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.
Copies free upon request.

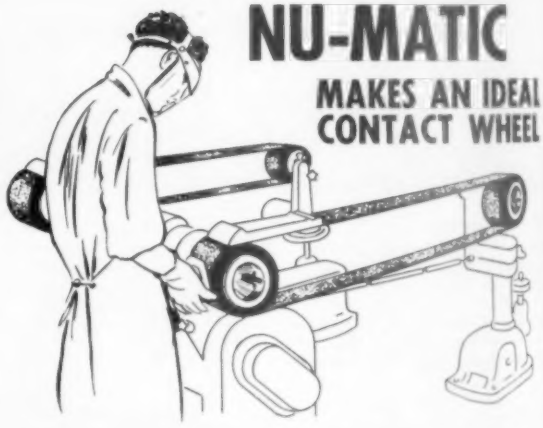
THE *Van Keuren* CO., 174 Waltham St., Watertown, Mass.

30 th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages Plug Gages • Measuring Wires • Thread Measuring

NU-MATIC

MAKES AN IDEAL CONTACT WHEEL



FOR BACK STAND IDLERS

Because Nu-Matic Grinders can be inflated for hard, medium and soft grinding surfaces, they eliminate the necessity for 3 wheels and changing wheels for different operations. Standard 3½" abrasive bands can be changed in a matter of seconds. Low pressures provide surfaces suitable for contour buffing and polishing. You'll be amazed at the many operations where Nu-Matic Grinders save time and money. Adapters for ⅝"—11 or ½"—13 power equipment. (Specify size.)

Adaptable to bench, portable or flexible shaft power.

NU-MATIC GRINDERS, INC., 10304 W. McNICHOLS RD.
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ASTE INDUSTRIAL EXPOSITION
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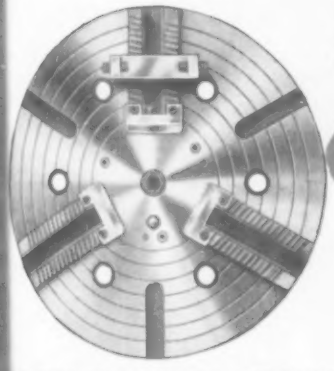
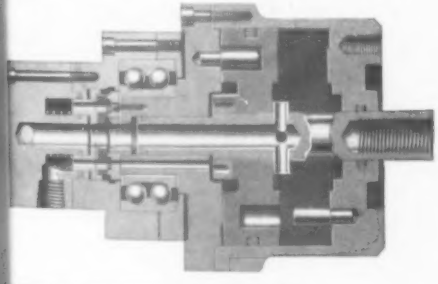
***Super-smooth High speed* OPERATION OF CHUCKS AND AIR CYLINDERS *with*_____**

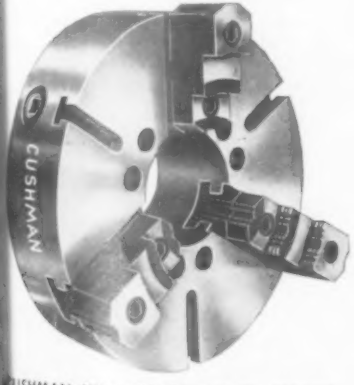
CUSHMAN *Static* BALANCING



CUSHMAN "ACCRALOCK"* POWER CHUCK



CUSHMAN ROTATING AIR CYLINDER



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Today, with the increasingly high speeds at which precision machine tools are operating, it is essential that vibration and chatter be eliminated from work holding and control equipment.

With Cushman Power and Wrench Operated Chucks . . . and with Rotating Air Cylinders, you are assured of a new degree of smoothness in operation. This is due to our accurate Balancing Checks throughout manufacture and after assembly of chuck bodies and cylinders. No product is shipped without a final static balance test . . . using the Gisholt Static Balancing Machine illustrated above. We believe this feature to be of great value to buyers of Cushman equipment to be used either for manual or power chucking.

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How you may lick your cost problems—or any production, engineering, or designing problem—is outlined in informative bulletins covering the subjects listed on the next page. They will be mailed on request without obligation to responsible business firms.

Request, on your letterhead, bulletin that interests you.

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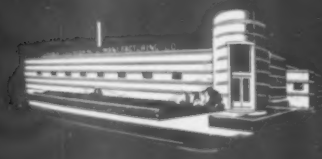
INTERNAL ORGANIZATION
Establishment of the framework to execute management's policies; simplification of routines to handle orders, records and reports with minimum paperwork; allocation of responsibility and authority to prevent friction caused by overlapping controls.

PRODUCT DESIGN AND DEVELOPMENT
Realistic comparison drawn between cost of developing and manufacturing a new product and probable realization of returns; existing products redesigned for increased sales appeal by comprehensive analysis of appearance, function and performance.

PRODUCTION METHODS
Study of production sequence to eliminate, combine, change order of, or simplify operations; analysis of basic process and recommendations for machines, tools and accessories to competently balance out production lines.

QUALITY CONTROL
Compilation of accumulative tolerance charts to assure any product meeting established manufacturing limits; correct location of inspection points and setting of standards and procedures to keep scrap at absolute minimum.

TOOL AND SPECIAL MACHINE DESIGN
Design of tools, dies, jigs, fixtures and gages to complement and implement any machine; modern production problems conquered by specially designed machine tools incorporating hydraulic, pneumatic or electronic controls.



TIME AND MOTION STUDY
Determination of quickest and best work sequence with suggested improvements in workplace, methods and tools; study of operators' physical movements to correct bad operating practices, lessen fatigue and increase efficiency.

MATERIAL HANDLING
Unbiased recommendation and selection of equipment best suited to job—whether it be hand trucks, truck tractors, power-lift trucks, stackers, gravity-roll, power or chain conveyors, cranes or hoists.

PLANT LAYOUT
Flexible plant arrangements for steady progression of production obtained through preparation of process flow charts which clearly reveal bottlenecks; charts may be projected into template or scale model layouts for even more detailed study.

PRODUCTION CONTROL
Channeling work through a plant so sales schedules are kept in definite balance with production capacity; machine loads are accurately charted to give assurance that delivery dates can be met.

COST CONTROL
Determination of pertinent cost information, currently accurate, for use as a means of establishing prices and operating efficiency, to guide and guard present conditions and intelligently chart an organization's future course.

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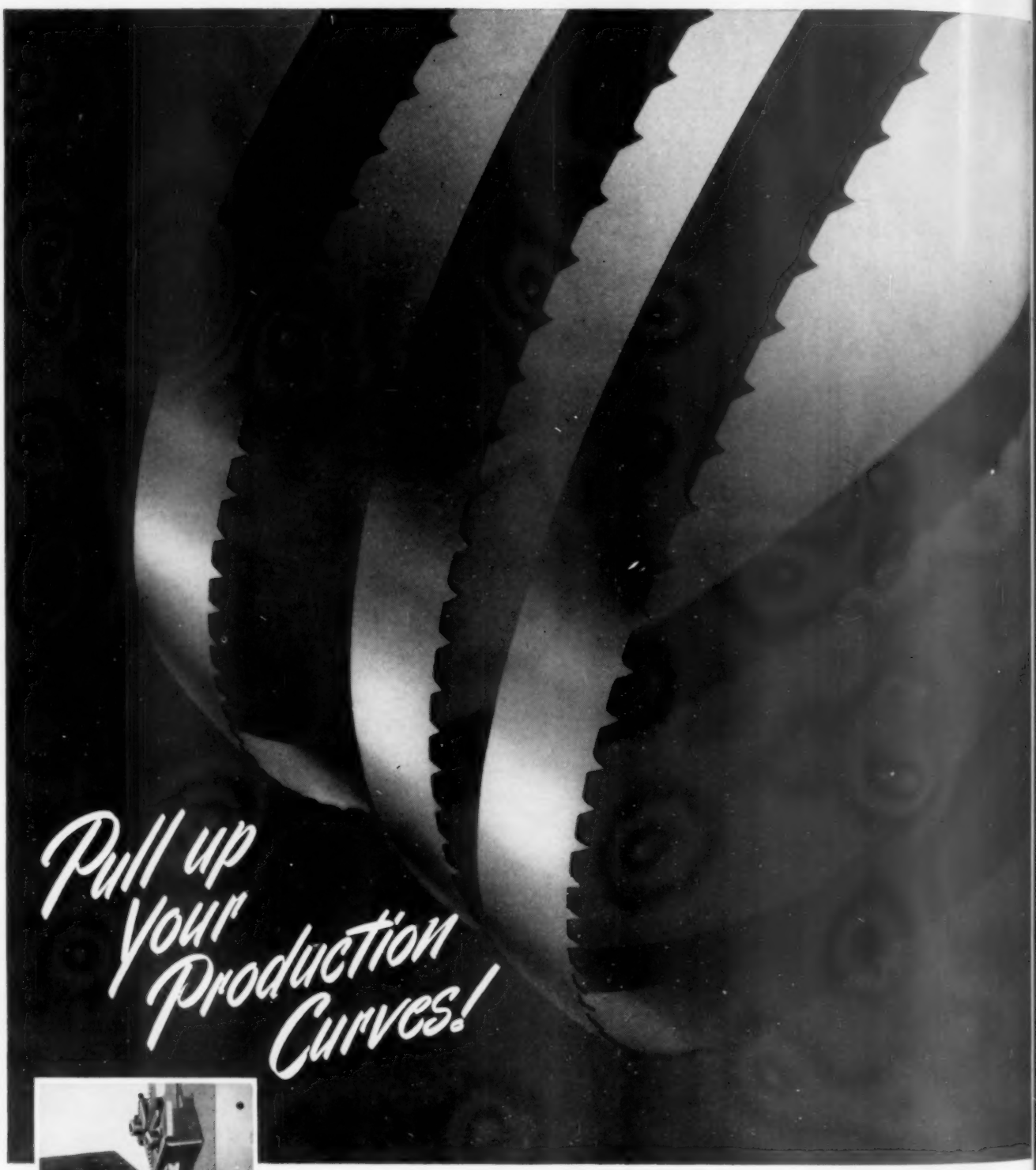

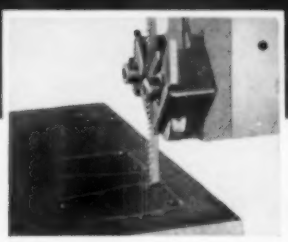

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These tough blades start life with a steel of special analysis. The Skip-Tooth Saw shown gives outstanding performance in cutting non-ferrous metals and composition materials at high speeds and feeds. But whether your requirements are for skip-tooth or regular-tooth saws on horizontal or vertical machines, you are assured of evenly milled, perfectly shaped teeth, with heat-treatment controlled for maximum efficiency. Have your Industrial Supply Distributor recommend the right Simonds Band Saw for YOUR job. Call him today!

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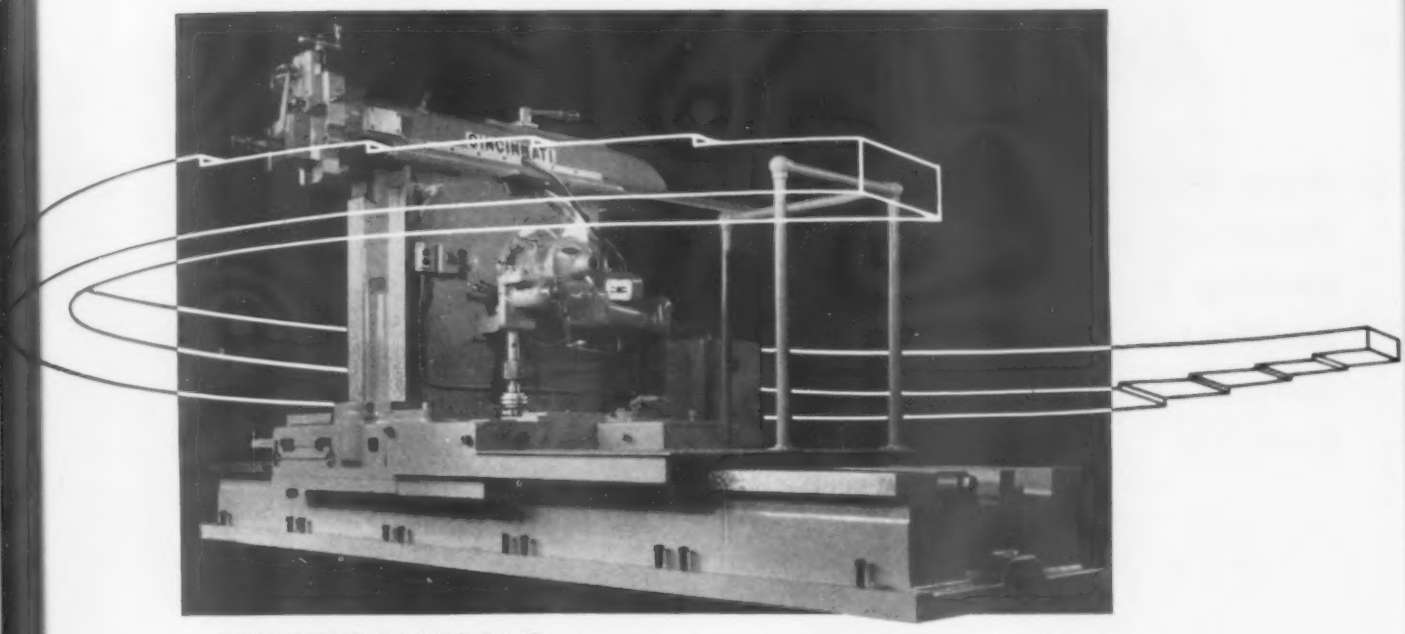
8 ft. OF CROSS FEED

ON THIS CINCINNATI SHAPER



ONE SETUP SAVES TIME. Seven feet at end of 20-foot diameter cast steel generator half rings is machined with one setup as shown in schematic sketch above.

NEW! This new Cincinnati Traveling Shaper accurately machines surfaces requiring eight feet of table travel—with one setup.

The operator rides with the machine so controls are always at hand. Accurate settings can be made easily at any point of travel with the vernier.

NEW ECONOMIES! This Cincinnati Traveling Shaper is effecting real economies for a large manufacturer of motor generators.

Steps are machined over a seven-foot length on the ends of seven-ton generator rings 20 feet in diameter. This one setup greatly reduces machining time on this otherwise awkward job.

NEW FIELDS! This application of powerful Cincinnati Shapers opens up new fields of use in the machining of long, interrupted surfaces on very large work.

Investigate the possibilities for you in this new Shaper development. Our Engineering Department will be glad to cooperate.

MANY APPLICATIONS, such as shaping slots in eight-foot table, are performed quickly and economically with a Cincinnati Traveling Shaper.

Write for the new Shaper Catalog—S-5.

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CINCINNATI 25, OHIO U.S.A.

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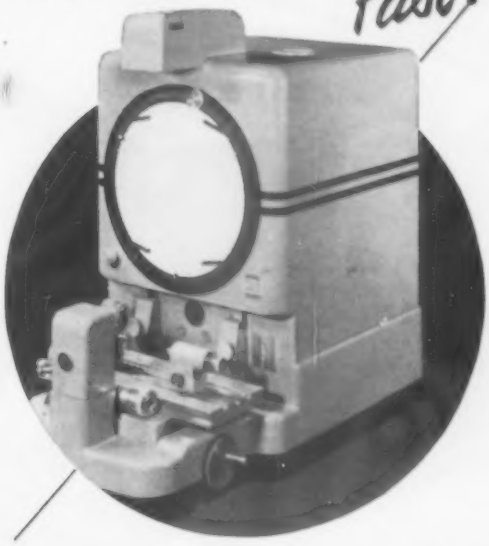

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Contour Machines—5 models from 16" to 60" capacity.

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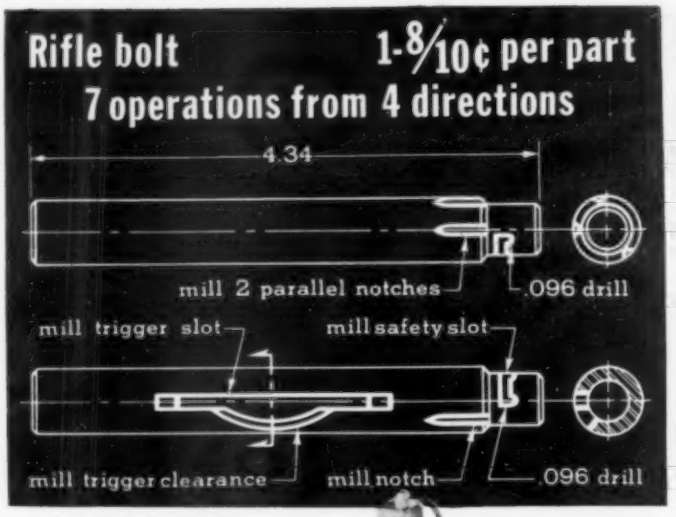
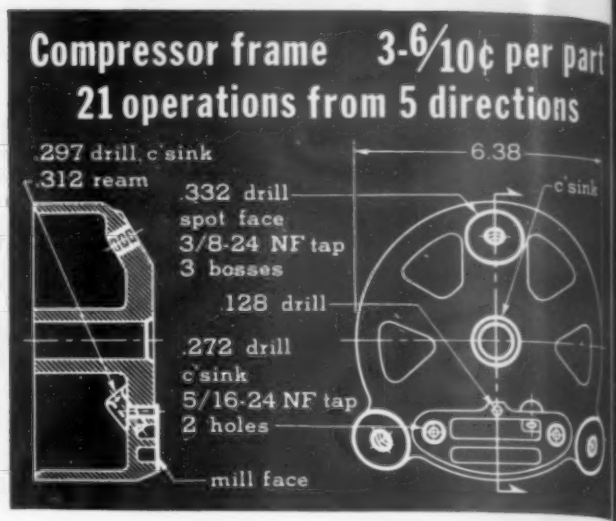
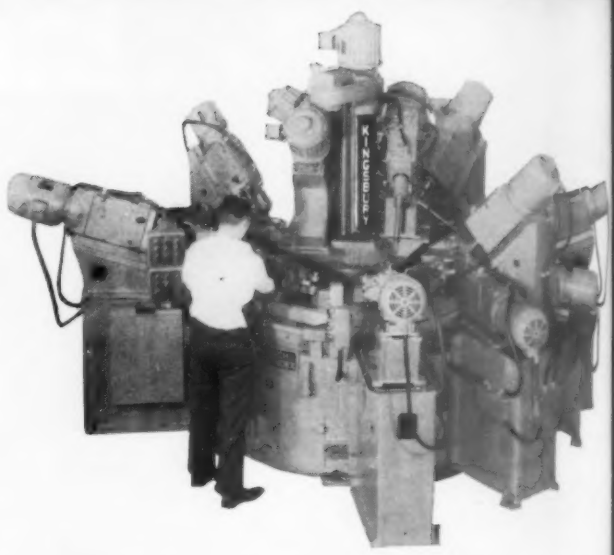




295 PARTS AN HOUR GROSS. A 20-inch power index table has seven fixtures. Two horizontal units off the radial lines drill the holes. Three radial horizontal units mill the slots and trigger clearance. Two vertical units mill the three notches.



390 PARTS AN HOUR GROSS. A 60-inch power index table has eight fixtures. At three stations nine units operate on three bosses. At four stations nine tools work from the front and units on the central column do the angular hole from the rear.

Combined operations cut

Single-purpose drilling and tapping machines, built to each customer's needs, produce much more per man-hour

Dear Sir:

General-purpose machines can do the operations above. But these Kingsburys do them much cheaper and much faster. A Kingsbury does thousands of operations each hour — all automatically. One operator loads and unloads the parts.

Units perform the operations

A suitable drilling or tapping unit does each operation. If necessary we add a milling attachment or multi-spindle auxiliary head. Each unit is automatic and has its own motor (1/3 to 5 hp). Units can be horizontal, vertical or at angles. (By the way, all 16 units for the compressor frame are at angles.) In one chucking of a part, a Kingsbury can do a variety of operations from many directions.

Uniform, accurate machining

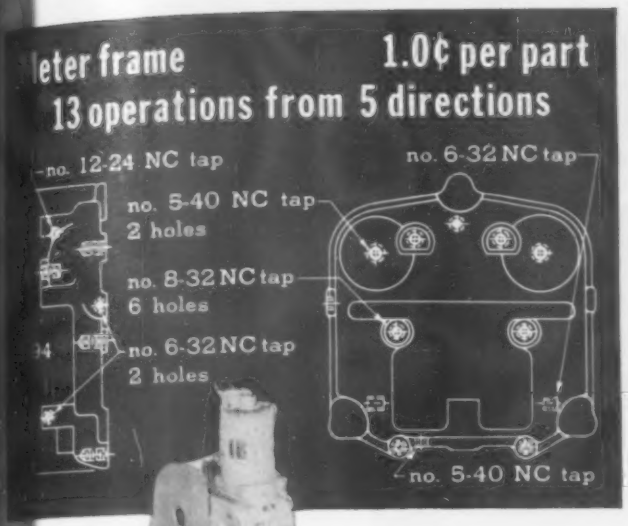
Machining is uniform. Each unit has an automatic cycle and cam feed that do not vary. All fixtures on any one machine are interchangeable. Each machine does many operations on the part while it stays in its fixture and no one touches it.

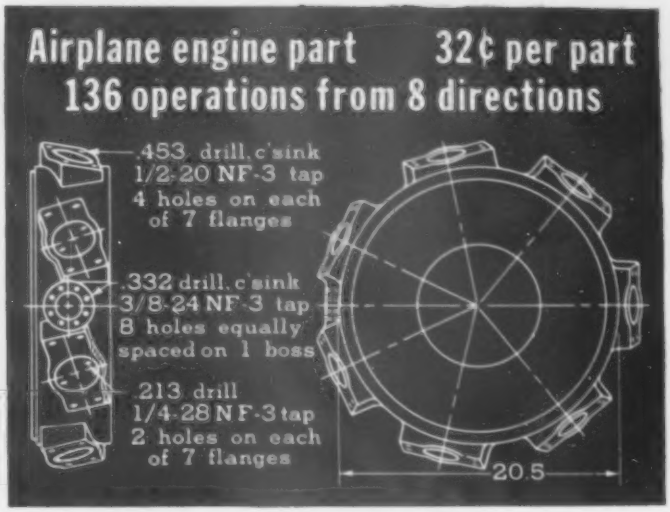
Tools work to close tolerances. Bushings guide drills and reamers. The bushings are in the fixtures or in plates that pilot to the fixtures.

You are the boss

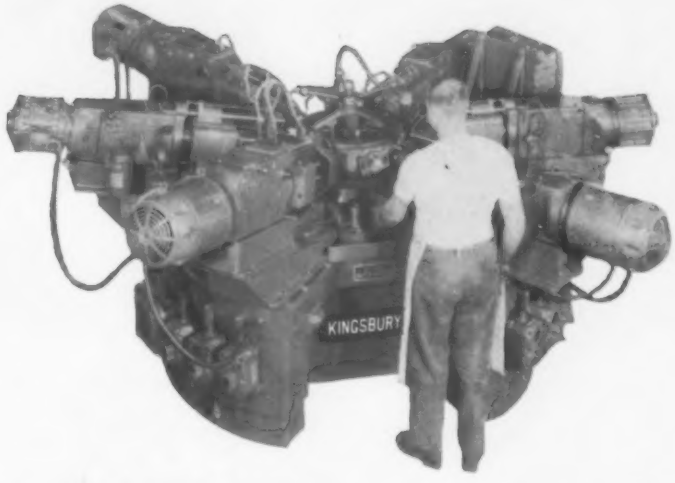
You name the output rate and the operations and approve the sequence. You approve our fixture design before we start engineering. You approve samples before we ship the machine.

Our key men take a real interest in your machine. They know it by name. If someone mentions an order number they ask, "Whose machine is that?" They attend to your requests on safety features, electrical equipment, tool holders, guide bushings, paint, etc. Even the president and vice-president





300 PARTS AN HOUR GROSS. One vertical and four horizontal units tap five sides of the same part at the same time. There is no indexing. Three units have multi-spindle auxiliary heads. Two Kingsburys ahead of this setup drill these and other holes.



21 PARTS AN HOUR GROSS. One part at a time indexes on its axis, 1/7 turn per index. Three angular units drill the flanges after indexes 1 to 7, countersink after 2 to 8 and tap after 3 to 9. Three horizontal units do the eight holes after indexes 1 to 3.

cost and increase output

spend most of their time on proposals and machines for our customers.

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Sincerely,
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STOPS LOSSES
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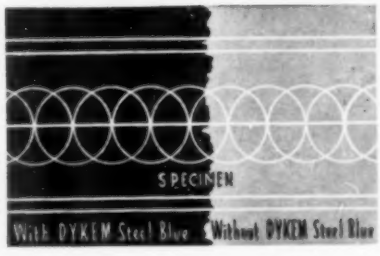

Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief and at the same time prevents metal glare. Increases efficiency and accuracy.

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To underscore the significance of this event the April issue of THE TOOL ENGINEER will be a special Convention and Exposition Issue. The many features of the issue will be of importance to readers and advertisers alike.

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Wales-Strippit Corporation
345 Payne Avenue
North Tonawanda, N. Y.

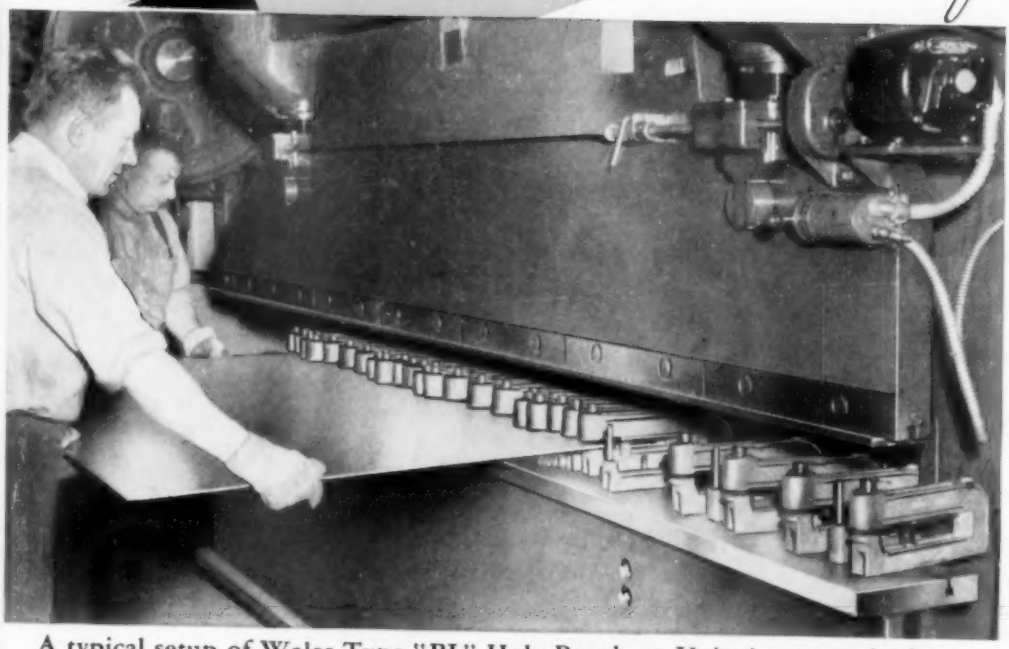
Attention: Mr. C...

accompanied by ... letter dated August 18 of various equipment using your Strippit dies. ... away which contained photos

We are a steady user of your patented Strippit equipment. If you will check your records you will see that We changed over our punching and notching operations to make use of your dies wherever possible, and are very happy to say that we are very much pleased with the result...

We notice that ... photograph...

Very truly yours,
STAINLESS FOOD EQUIPMENT CO.
J. Ferlauto



A typical setup of Wales Type "BL" Hole Punching Units in a press brake at Stainless Food Equipment Company.

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